KUENY ARCHITECTS, L.L.C.

SPECIFICATION FOR

PROJECT:

Kenosha County Center Generator

OWNER:

Kenosha County
19600 75th Street
Bristol, WI 53104

SPECIFICATION DATE:

May 31, 2023

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DIVISION 32 EXTERIOR IMPROVEMENTS

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SECTION 01 30 00 PROJECT COORDINATION

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

INDEX

PART 1 GENERAL

1.1 Description

A. Work Included
   1. Contractor will coordinate the Work of the entire Project.
   2. The Contractor shall:
      a. Coordinate work of their own employees and subcontractors.
      b. Expedite their work to assure compliance with schedules.
      c. Coordinate their work with that of other prime contractors and work by Owner.
      d. Comply with orders and instructions of the Owner.

B. Related Work Specified Elsewhere: Division 1.

PART 2 PERSONNEL

2.1 Project Manager

A. The General Contractor and each of the Mechanical and Electrical sub-contractors shall designate a qualified project manager for the duration of the construction work.
   1. Qualification:
      a. A minimum of five years of experience in field work required for this type and size of Project.
   2. Submit name to Architect.
   3. The Project Manager shall not be the same person as the Superintendent. The Project Manager shall work in concert with the Superintendent on this project.

B. General Contractors: Per Section 00 72 00, Article 3.9 of the A201, a qualified project superintendent must be present on the job during performance of the work. The superintendent must be on site all day, min. 8 hours during the construction period and it is not acceptable to be a part time superintendent.

PART 3 EXECUTION

3.1 General Duties of Project Managers

A. Construction Organization and Start-up
   1. Project Managers shall establish on-site lines of authority and communications:
      a. Establish procedures for intra-project communication:
         (1) Submittals
         (2) Reports and records

(3) Recommendations
(4) Coordination drawings
(5) Schedules
(6) Resolution of conflicts.

b. Interpret Contract Documents:
(1) Consult with Architect to obtain interpretations.
(2) Assist in resolution of questions or conflicts which may arise.
(3) Transmit written interpretations to Prime Contractors, and to other concerned parties.

c. Assist in obtaining permits and approvals:
(1) Building permits and special permits required for Work or for temporary facilities.
(2) Verify that contractors and subcontractors have obtained inspections for Work and for temporary facilities.

B. Project Manager Duties
1. Prepare Coordination Drawings as required to resolve conflicts and to assure coordination of the Work of, or affected by, mechanical and electrical trades, or by special equipment requirements.
a. Submit to Architect.
b. Reproduce and distribute copies to concerned parties after Architect review.
2. Inspection and Testing:
a. Inspect Work to assure performance in accord with requirements of Contract Documents.
b. Administer special testing and inspections of suspect Work.
c. Reject Work which does not comply with requirements of Contract Documents.
d. Coordinate Testing Laboratory Services:
(1) Verify that required laboratory personnel are present.
(2) Verify that tests are made in accord with specified standards.
(3) Review test reports for compliance with specified criteria.
(4) Recommend and administer any required retesting.
3. Monitor the use of temporary utilities:
a. Verify that adequate services are provided and maintained.
b. Coordinate installation, operation and maintenance, to verify compliance with project requirements and with Contract Documents.
c. Coordinate use of Owner’s facilities.
4. Monitor Contractor’s periodic cleaning:
a. Enforce compliance with Specification.
b. Resolve any conflicts.
5. Arrange for delivery of Owner-furnished products.
a. Inspect for condition at delivery.
b. Turn over to appropriate Contractor, obtain receipt.
6. Changes and Substitutions:
a. Recommend necessary or desirable changes to Owner and to Architect.
b. Review subcontractors’ requests for changes and substitutions; submit recommendations to Owner and to Architect.
c. Assist Architect in negotiating Change Orders.
d. Promptly notify all subcontractors of pending changes or substitutions.

7. Provide cost control for Project:

a. Revise and refine the approved estimate of construction cost periodically:
   (1) Record actual costs and estimates for uncompleted work.
   (2) Incorporate approved changes as they occur.
   (3) Develop cash flow reports and projections.
b. Maintain cost accounting records for authorized work performed under:
   (1) Unit costs.
   (2) Actual costs for labor and materials.
   (3) Other basis requiring accounting records.
c. Implement procedures for review and processing of Contractor's applications for progress payments and for final payments;
   (1) Review each application for payment, submit recommendations to Architect.

8. Maintain Reports and Records at Job Site, available to Architect and Owner.
   a. Daily log of progress of Work.
   b. Records:
      (1) Contracts
      (2) Purchase orders.
      (3) Materials and equipment records.
      (4) Applicable handbooks, codes and standards.
   c. Obtain information from subcontractors and maintain file of record documents.
   d. Assemble documentation for handling of claims and disputes.
9. Coordinate the work schedules of the subcontractors:
   a. For temporary utilities.
   b. Among the work of the trades specified in Division 23 and 26.
   c. With the work of trades specified in Division 2 through 26.
10. Coordinate the schedules of subcontractors.
   a. Verify timely deliveries of Products for installation by other trades.
   b. Verify that labor and materials are adequate to maintain schedules.
11. Conduct conferences among subcontractors and other concerned parties as necessary to:
   a. Maintain coordination and schedules.
   b. Resolve matters in dispute.
12. Participate in Project Meetings:
   a. Report progress of Work.
   b. Recommend needed changes in schedules.
   c. Transmit minutes of meetings to trades, as appropriate.
13. Temporary Utilities:
   a. Coordinate installation, operation and maintenance, to verify compliance with Project requirements and with Contract Documents.
   b. Verify adequacy of service at required locations.
14. Shop Drawings, Product Data Samples:
   a. Prior to submittal, review for compliance with Contract Documents.
      (1) Check field dimensions and clearance dimensions.
      (2) Check relation to available space.
      (3) Check anchor bolt settings.
      (4) Review the effect of any changes on the work of other contracts or trades.
      (5) Check compatibility with equipment and work of other trades.
      (6) Check motor voltages and control characteristics.
      (7) Coordinate controls and interlocks:
         (a) Voltages
         (b) Wiring of pneumatic electric switches or relays.
      (8) Coordinate wiring and control diagrams.

15. Job Site Visits:
    a. Project Managers shall visit site monthly until work of their contract begins.
    b. Visit site weekly after Contractor has begun.
16. Verify that subcontractors maintain accurate record documents.
17. Observe Work for compliance with requirements of Contract Documents.
    a. Maintain list of observed deficiencies and discrepancies.
    b. Promptly report deficiencies or discrepancies to Architect.
    c. Record results including time and date of start-up.
18. Equipment Startup:
    a. Check to assure that utilities and specified connections are complete and that equipment is in operable condition.
    b. Observe test adjust and balance.
    c. Record results including time and date of start-up.
19. Inspection and Acceptance of Equipment:
    a. Prior to inspection, check that equipment is clean, repainted as required, tested and operational.
    b. Assist inspector; prepare list of items to be completed or corrected.
    c. Should acceptance and operation of equipment constitute the beginning of the specified warranty period, prepare and transmit written notice to Architect for the Owner.
20. Assemble Record Documents from subcontractors and transmit to Architect.

C. Project Manager's Close-out Duties
    1. Mechanical and Electrical equipment start-up:
        a. Coordinate check-out of utilities, operational systems and equipment.
        b. Assist in initial start-up and testing.
        c. Record dates of start of operation of systems and equipment.
        d. Submit to Owner written notice of beginning of warranty period for equipment put into service.
    2. At completion of Work of each Contract, conduct an inspection to assure that:
        a. Specified cleaning has been accomplished.
        b. Temporary facilities have been removed from site.
    3. Substantial Completion:
        a. Conduct an inspection to confirm or supplement Contractor's list of work to be completed or corrected.
        b. Assist Architect in inspection.
        c. Supervise correction and completion of work as established in Certificate of Substantial Completion.
    4. When Owner occupies a portion of Project prior to final completion, coordinate established responsibilities of Contractor and Owner.
    5. Final Completion:
        a. When each Contractor determines the Work is finally complete, conduct an inspection to verify completion of Work.
        b. Assist Architect in inspection.
    6. Administration of Contract Closeout:
        a. Receive and review subcontractors' final submittals.
        b. Transmit to Architect with recommendations for action.
D. Additional Duties of General Contractor's Project Manager
    1. Control the use of Site:

a. Supervise field engineering and site layout.
b. Allocate space for each Prime Contractor's use for field offices, sheds and work and storage areas.
c. Allocate field office and storage space, and work and storage areas, for use of each Prime Contractor.
d. Establish access, traffic and parking allocations and regulations.
e. Monitor use of site during construction.

2. Construction Schedules:
   a. Coordinate schedules of the several Prime Contractors.
   b. Prepare a detailed schedule of basic operations for all Prime Contractors.
      (1) Each Prime Contractor shall prepare sub-schedules to comply with critical phases.
   c. Monitor schedules as work progresses:
      (1) Identify potential variances between scheduled and probable completion dates for each phase.
      (2) Recommend to Owner adjustments in schedule to meet required completion dates.
      (3) Adjust schedules of Contractors as required.
      (4) Document changes in schedule, submit to Owner, Architect and to involved Contractors.
   d. Observe work of each Contractor to monitor compliance with schedule.
      (1) Verify that labor and equipment are adequate for the Work and the schedule.
      (2) Verify that product procurement schedules are adequate.
      (3) Verify that product deliveries are adequate to maintain schedule.
      (4) Report noncompliance to Owner with recommendation for changes.
3. Daily Reports: Establish a procedure for the General Contractor's job superintendent to write a daily report on the progress of the job. These reports will be sent to the Architect at the end of each week. The report will include date, weather conditions, temperatures, manpower for all prime Contractor's and subcontractor's work being done by all prime contractors, problems and delays, extra work done or materials purchased.

3.2 Coordination Between Contractors at the Project Site

A. All Contractors and all subcontractors shall coordinate their work with adjacent work and shall cooperate with all other trades so as to facilitate the general progress of the Work. Each trade shall afford all other trades every reasonable opportunity for the installation of their work and for the storage of their material. In no case will any Contractor be permitted to exclude from the premises or Work, any other Contractor or their employees, or interfere with any Contractor in the execution or installation of their work.

B. Each trade shall perform its work in proper sequence in relation to that of other contractors or trades and as approved by the Architect. Any cost caused by defective or ill-timed work shall be borne by the trade responsible therefore.

C. Each Contractor shall arrange its Work and dispose of its materials so as not to interfere with the Work or storage of materials of other Contractors and each shall join their work to that of others in accord with the intent of the Drawings and Specifications.

D. All mechanical and electrical contractors shall work in cooperation with the General Contractor and with each other, and fit their piping, ductwork, conduit, etc., into the structure as job conditions may demand. All final decisions as to the right-of-way and run of pipe, ducts etc., shall be made by the Architect or his/her representative at prearranged meetings with responsible representatives of the mechanical and electrical contractors.

E. Each Contractor shall give due notice and proper information to other Contractors of any special provisions necessary for the placing or setting of their work coming in contact with work of other Contractors. Failing to do so in proper time, they will be held responsible and shall pay for any and all alterations and repairs necessitated by such neglect.

F. It shall be the responsibility of all Contractors and all subcontractors to keep constant check on the progress of the Work so that the particular trade can ensure proper preparation for installation of that trade's work and not cause delay in the progress of the Work. It shall be the responsibility of each contractor to periodically make inspections of Work in progress and to notify the Architect when Work is complete in compliance with Specifications and Drawings.

G. Contractors for Fire Protection, Plumbing, Heating and Ventilating and Electrical Work shall check and cross check the Drawings and Specifications of other trades to inform themselves of the work interrelated with their work.

H. Any voluntary effort on the part of the Architect to expedite the notice to other Contractors shall not relieve any Contractor of their primary responsibility to give such notice.

I. Contractors shall determine as far in advance as possible the exact size of openings and guarantee them to the General Contractor.

J. All Contractors working on the site shall coordinate storage of materials on ground slabs and on above ground floor and roof members so as not to exceed the design live load shown on the Drawings. Material storage will not be allowed on any cantilevered members. Contractors will take immediate remedial action when so directed by the Architect.

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SECTION 01 31 19 PROJECT MEETINGS

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

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PART 1 GENERAL

1.1 Description

A. Work Included: Throughout the course of the Work, in order to provide coordination of the Project, the Architect will schedule meetings which will include but are not limited to:
   1. Preconstruction Conference
   2. Progress Meetings
   3. Completion Inspection Meeting

B. Related Requirements Specified in Other Sections

1. Construction Schedules	Section 01 30 00
2. Submittals, Shop Drawings and Samples	Section 01 33 00
3. Project Record Documents	Section 01 70 00
4. Operating and Maintenance Data	Section 01 70 00

C. Related Requirements in Other Parts of the Project Manual
   1. Pre-Bid Conference: Instruction to Bidders

D. Definitions: See General Conditions

PART 2 PRODUCTS

2.1 Preconstruction Meeting

A. Schedule within fifteen (15) days after date of Notice to Proceed.

B. Location: The Architect will designate a central site convenient for all parties.

C. Attendance
   1. All persons named on the Representatives List described in Part 3 of this Section.
   2. Major subcontractors.
   3. Major suppliers.
   4. Others as appropriate.

D. Suggested Agendum
   1. Distribution and discussion of:
      a. List of major subcontractors and suppliers
      b. Projected construction schedules.
   2. Critical work sequencing.

3. Major equipment deliveries and priorities.
4. Project coordination; designation or responsible personnel.
5. Procedures and processing of:
   a. Field decisions
   b. Proposal requests
   c. Submittals
   d. Change orders
   e. Application for payment
6. Adequacy of distribution of Contract Documents.
7. Procedures for maintaining Record Documents.
8. Use of premises:
   a. Office, work and storage areas.
   b. Owner's requirements.
9. Construction facilities, controls and construction aids.
10. Temporary utilities.
11. Safety and first-aid procedures.
12. Security procedures.
13. Housekeeping procedures.

2.2 Progress Meetings

A. Schedule regular periodic meetings, as required.

B. Hold called meetings as required by progress of the Work.

C. Location of the Meetings: The project field office.

D. Attendance
   1. Architect's, Owner's and Contractor's representatives as shown on Representatives List in Part 3 of this Section.
   2. Subcontractors as appropriate to the Agenda.
   3. Suppliers as appropriate to the Agenda.
   4. Others.

E. Suggested Agendum
   1. Review, approval of minutes of previous meeting.
   2. Review of Work progress since previous meeting.
   3. Field observations, problems, conflicts.
   4. Problems which impede Construction Schedule
   5. Review of off-site fabrication; delivery schedules.
   6. Corrective measures and procedures to regain projected schedule.
   7. Revisions to Construction Schedule.
   8. Plan progress schedule, during succeeding work period.
   9. Coordination of schedule.
   10. Review submittal schedules; expedite as required.
   11. Maintenance of quality standards.
   12. Review proposed changes for:
      a. Effect on Construction Schedule and on completion date.
      b. Effect on other contracts of the Project.
   13. Perform business.

2.3 Completion Inspection Meeting

A. Schedule after Punch List has been returned to Architect and before final payment.

B. Location: A walk-though of the entire project.

C. Attendance
   1. Architect
   2. Owner's Representatives
   3. Field Superintendent for each prime Contractor.
   4. Subcontractors as requested.
   5. Engineers

D. Suggested Agendum
   1. Review of Punch List items not completed.
   2. Review of Project requirements for determination of final payment.

2.4 One and Two Year Warranty Review Meeting: Approximately eleven (11) months and twenty three (23) after the date of substantial completion the Architect, Owner and Contractor will inspect the project and develop a list of items to be corrected under the provisions of the One-Year Warranty division of the General Conditions.

PART 3 EXECUTION

3.1 Representative List: After Contracts are awarded, each Contractor will submit to the Architect the names of the Project Manager and Field Superintendent. The Architect will then compile a list of all the representatives of the Owner, Architect, Engineers and Contractors who are authorized to make decisions about the Project and distribute this list to all interested parties.

3.2 Meetings

A. The General Contractor shall schedule and administer pre-construction meeting, periodic progress meetings and specially called meetings throughout the progress of the Work.
   1. Prepare agenda for meetings.
   2. Distribute written notice of each meeting four (4) days in advance of meeting date.
   3. Make physical arrangements for meetings.
   4. Preside at meetings.
   5. Record the minutes; include all significant proceedings and decision.
   6. Reproduce and distribute copies of minutes within three (3) days after each meeting.
      a. To all participants in the meeting.
      b. To all parties affected by decisions made at the meeting.

B. Representatives of Contractors, Subcontractors and suppliers attending the meeting shall be qualified and authorized to act on behalf of the entity each represents.

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SECTION 01 33 00 SUBMITTALS

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

INDEX

PART 1 GENERAL

1.1 Description

A. Work Included
1. To ensure that the specified products are furnished and installed in accord with design intent, procedures have been established for advance submittal of design data and for its review by the Architect.
2. Construction Schedule
3. Progress Reports
4. Shop Drawings
5. Product Data
6. Samples
7. Layout Data
8. Schedule of Values
9. Instruction Manuals

B. Related Requirements Specified Elsewhere
1. General Conditions
   a. Progress Schedule
   b. Shop Drawings, Product Data and samples
   c. Schedule of Values
2. Material and Equipment — Section 01 60 00
3. Project Closeout — Section 01 70 00
4. Cast in Place Concrete — Section 03 30 00
5. Metal Fabrications — Section 05 50 00
6. Painting — Section 09 91 00

C. Definitions
1. Shop Drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor or any subcontractor, manufacturer, supplier or distributor and which illustrate some portion of the Work.
2. Samples are physical examples furnished by the Contractor to illustrate materials, equipment or workmanship and to assist in the establishment of standards by which the work will be judged.

1.2 Submittals

A. Construction Schedule
1. Submit initial schedules within fifteen (15) days after date of Award of Contract.

a. Architect will review schedules and return review copy within ten (10) days after receipt.
b. If required, resubmit within seven (7) days after return of review copy.

2. Submit periodically updated schedules accurately depicting progress on first day of each month.

B. Shop Drawings, Product Data and Samples
1. Schedule submissions at least fourteen (14) days before dates reviewed submittals will be needed.
2. Submit number of copies of Shop Drawings, Product Data and Samples which Contractor required for distribution plus two copies which will be retained by the Architect. An additional copy shall be submitted for mechanical engineers as required.
3. Accompany submittals with transmittal letter, in duplicate, containing:
   a. Date
   b. Project title and number
   c. Contractor's name and address
   d. The number of each Shop Drawing, Product Data and Sample submitted.
4. Submittals shall include:
   a. Date and revision dates.
   b. Project title and number.
   c. The names of:
      (1) Architect or Engineer
      (2) Contractor
      (3) Subcontractor
      (4) Supplier
      (5) Manufacturer
      (6) Separate detailer when pertinent.
   d. Identification of product or material.
   e. Relation to adjacent structure or materials.
   f. Field dimensions clearly identified as such.
   g. Specification Section number.
   h. Applicable standards, such as ASTM number.
   i. Identification of deviations from Contract Documents clearly marked in a different color. Provide a summary of deviations on the front sheet of the submittal.
   j. Contractor's stamp, initialed or signed, certifying to review of submittals, verification of field measurements and compliance with Contract Documents.
5. Resubmission Requirements:
   a. Shop Drawings:
      (1) Revise initial drawings as required and resubmit as specified for initial submittal.
      (2) Indicate on drawings any changes which have been made other than those requested by Architect.
      (3) Product Data and Samples: Submit new data and samples as required for initial submittal.
6. Distribution of submittals after review:
   a. Distribute copies of Shop Drawings and Product Data which carry Architect's stamp to:
      (1) Contractor's file
      (2) Job-site file
      (3) Record document file

(4) Other prime contractors
(5) Affected subcontractors
(6) Suppliers
(7) Fabricator
(8) Erector

b. Distribute samples as directed.

7. Note: Architect will not accept any drawing or data that has been transmitted by means of telephone or facsimile. Submittals may be transmitted via electronic mail or using a project management web application.
8. Provide sufficient space for both Contractor's and Architect's Review Stamp.

PART 2 PRODUCTS

2.1 Shop Drawings

A. Original drawings, prepared by Contractor, subcontractor, supplier or distributor, which illustrate some portion of the Work; showing fabrication, layout, setting or erection details.

B. Prepared by a qualified detailer.

C. Identify details by reference to sheet, room schedule, detail numbers or other identification for coordinating with Contract Drawings.

D. Reproductions for Submittals: Submittals made on paper should be provided with five copies in blue or black line on white background.

E. Unless otherwise specifically directed by the Architect, make all Shop Drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the Work.

F. One set of corrected drawings used for fabrication will be made available on the Owner's request.

2.2 Product Data

A. Manufacturer's Standard Schematic Drawings:
1. Modify drawings to delete information which is not applicable to project.
2. Supplement standard information to provide additional information applicable to Project.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.
1. Clearly mark each copy to identify pertinent materials, products or models.
2. Show dimensions and clearances required.
3. Shop performance characteristics and capacities.
4. Show wiring diagrams and controls.

2.3 Samples

A. Physical examples to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged.

B. Office Samples: Of sufficient size and quantity to clearly illustrate:
   1. Functional characteristics of product or material with integrally related parts and attachment devices.
   2. Colors: Submit accurate color charts and pattern charts to the Architect for review and selection as required. Indicate any cost differential between samples.
   3. After review, samples may be used in construction of Project.

C. Field Samples and Mock-ups: Erect at Project site at location acceptable to the Architect.

PART 3 EXECUTION

3.1 Shop Drawings, Product Data and Samples

A. Contractor Responsibilities
   1. Review Shop Drawings, Product Data and Samples prior to submission. The Contractor will be responsible to submit samples which are to be available during the period of construction.
   2. Verify
      a. Field measurements
      b. Field construction criteria
      c. Catalog numbers and similar data.
   3. Secure all necessary approvals from public agencies and others and signify by stamp or other means that they have been secured.
   4. Coordinate each submittal with requirements of Work, Contract Documents, all trades, and public agencies involved.
   5. Contractor's responsibility for errors and omissions in submittals is not relieved by Architect's review of submittals.
   6. Begin no work which requires submittals until return of submittals with Architect's stamp and initials or signature indicating review. The Architect takes no responsibility for items delivered to the site and will reject if no Shop Drawings were submitted.
   7. Notify Architect, in writing, at time of submission, of deviations in submittals from requirements of Contract Documents.
   8. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Architect's review of submittals, unless Architect gives written acceptance of specific deviations. Corrections required in the field due to failure to submit the required documents for review shall be made at no cost to the Owner or Architect.
   9. Work started or materials released for production prior to receiving returned submittals indicating "Reviewed" or "Reviewed as Noted" shall be at the Contractor's sole risk.
   10. Begin no work related to submittals returned as "Rejected "or "Revise and Resubmit" unless specifically noted on the review by the Architect. Immediately work with the supplier to provide corrected or revised documents for resubmittal as noted on the returned submittal.

11. After Architect reviews indicating either “Reviewed” or “Reviewed as Noted”, distribute copies.

B. Architect’s Duties (General Conditions)
1. Review submittals with reasonable promptness.
2. Review for:
   a. Design concept of Project.
   b. Information given in Contract Documents.
3. Review of separate item does not constitute review of an assembly in which item functions.
4. Affix stamp and initials or signature certifying to review of submittal.
5. Return submittals to Contractor for distribution.
6. Review of Shop Drawings by Architect/Engineer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory.
   Review of such drawings will not relieve Contractor of responsibility for any error which may exist in the submittals as Contractor shall be responsible for dimensions and design of adequate connections, details and satisfactory construction of all work.
7. The Architect will only check those submittals which have been prepared by the Contractor or subcontractor that is actually supplying, fabricating or installing the product to be reviewed. Any evidence that the submittal was prepared by a prime contractor for a subcontractor without the subcontractor’s knowledge will result in the submittal being returned marked Rejected/Resubmit.
8. The Architect’s stamp, affixed to the Shop Drawing, means only what is says; that the submittal has been reviewed and is released for fabrication “as is” or “as noted,” must be resubmitted or has been rejected. The stamp does not represent a Change Order Authorization. The Contractor will bear all increased costs for reviewed products that have not been previously approved by the Architect for use on this Project.

C. Timing
1. General
   a. Make all submittals far enough in advance of scheduled dates of installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.
   b. In scheduling, allow at least ten (10) full working days for the Architect’s review following receipt of the submittal.
   c. Mechanical and Electrical submittals should be allowed additional lead time for Engineer’s review.
   d. Submittals pertaining to color selection are interdependent. No colors will be selected without all samples.
2. Delays: Costs of delays occasioned by tardiness of submittals maybe back charged as necessary and shall not be borne by the Owner. Such costs will include the purchase, installation and removal of temporary materials, equipment and fixtures, as required, in writing, by the Owner to allow the Project to be used or occupied until the permanent materials, equipment and fixtures can be installed.
   The Owner will not be forced to accept alternate materials, equipment, fixtures or colors because of the failure of the Contractor’s to make timely submission of Shop Drawings and product data.

D. Submittal Schedule: Submittals required by the various Sections of these Specifications include, but are not necessarily limited to:

	Work	Field Approval	Shop Drawings	Samples	Color Selections	Manuals	Instruction Methods	Product Data
01 70 00	Contract Close-out Items		X					
03 30 00	Concrete Mix Designs Reinforcing Steel		X					X
05 50 00	Miscellaneous Metals		X					
09 91 00	Paint	X	X	X	X	X	X	X
26	Electrical	X				X	X	X

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SECTION 01 60 00 MATERIALS AND EQUIPMENT

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

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PART 1 GENERAL

1.1 Description

A. Work Included: The Work under this Section will ensure the proper handling and protection of materials and establish methods for product approval and shall include but is not limited to:
   1. Transportation and handling
   2. Storage and protection
   3. Installation requirements
   4. Identifying markings
   5. Product approval standards
   6. Substitutions and product options

B. Related Work Specified Elsewhere

1. Substitutions during bidding	Instructions to Bidders
2. Coordination	Section 01 30 00
3. Schedule of Values	Section 01 30 00
4. Shop Drawings, Project Data, Samples	Section 01 33 00

C. Definitions
   1. “Or Equal” Clause: Whenever the Contract Documents designate any article, material or equipment by describing a propriety product or by using the name of a Manufacturer or vendor, the term “or equal” shall apply. The article, material or equipment so named shall be understood to define a type, function, minimum standard of design, efficiency and quality desired, and is not intended to eliminate competition. The Contractor may, by complying with the requirements of Article E of the Instructions to Bidders, use authorized substitutions in the Bid. Determination of “or equal” products is the responsibility of the Architect. The burden is on the Manufacturer, who has not been specified by name, to convince the Architect that the product is equal.

1.2 Submittals

A. Product Approval
   1. Within fifteen (15) days after date of Contract, submit to Architect five (5) copies of complete list of all products which are proposed for installation.
   2. Tabulate list by each Specification Section.
   3. For products specified under reference standards, include with listing of each product.

a. Name and address of Manufacturer
b. Trade name.
c. Model or catalog designation.
d. Manufacturer's data.
(1) Performance and test data.
(2) Reference standards.

B. Substitutions
1. Architect will consider substitutions quoted with Base Bid, and requests submitted with Bid.
2. Within 15 days after date of Contract, Architect will consider formal requests from Contractor for substitution of products in place of those specified.

PART 2 PRODUCTS

2.1 Materials and Equipment

A. General
1. Materials and equipment incorporated into the Work
a. Conform to applicable Specifications and Standards.
b. Comply with size, make, type and quality specified, or as specifically approved in writing by the Architect.
c. Manufactured and Fabricated Products:
(1) Design, fabricate and assemble in accord with the best engineering and shop practices.
(2) Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
(3) Two or more items of the same kind shall be identical, by the same Manufacturer.
(4) Products shall be suitable for service conditions.
(5) Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
d. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

B. Manufacturer's Instructions
1. When Contract Documents require that installation of Work shall comply with Manufacturer's printed instructions, obtain and distribute copies of such instructions, obtain and distribute copies of such instructions to parties involved in the installation and until completion;
a. Maintain one set of complete instructions at the Project site during installation and until completion.
2. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements;
a. Should Project conditions or specified requirements conflict with Manufacturer's instructions, consult with Architect for further instructions.
3. Perform work in accord with Manufacturer's instructions. Do no omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

C. Identifying Markings: Nameplates and markings required by codes or regulations or as required for proper operation of equipment shall be affixed for ready access but shall not be placed on exposed surfaces unless required otherwise.

2.2 Transportation and Handling

A. Delivery
   1. Arrange deliveries of products in accord with construction schedules and in ample time to facilitate inspection prior to installation.
   2. Coordinate deliveries to avoid conflict with Work and conditions at site:
      a. Work of other Contractors or Owner.
      b. Limitations of storage space.
      c. Availability of equipment and personnel for handling products.
      d. Owner's use of premises.
   3. Deliver products in undamaged condition in original containers or packaging with identifying labels intact and legible.
   4. Partial deliveries of component parts of equipment shall be clearly marked to identify the equipment, to permit easy accumulation of parts and to facilitate assembly.
   5. Immediately on delivery, inspect shipment to ensure:
      a. Product complies with requirements of Contract Documents and reviewed submittals.
      b. Quantities are correct.
      c. Containers and packages are intact, labels are legible.
      d. Products are properly protected and undamaged.

B. Product Handling
   1. Provide equipment and personnel necessary to handle products, including those provided by Owner by methods to prevent soiling or damage to products or packaging.
   2. Provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.
   3. Handle products by methods to prevent bending or overstressing.
   4. Lift heavy components only at designated lifting points.

2.3 Storage and Protection

A. Storage
   1. Store products immediately on delivery, and protect until installed in the Work;
      a. Store in accord with Manufacturer's instructions, with seals and labels intact and legible.
   2. Store products subject to damage by elements in substantial weathertight enclosures.
   3. Exterior Storage:
      a. Provide substantial platforms, blocking or skids to support fabricated products above ground, prevent soiling or staining;
         (1) Cover products, subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
      b. Store loose granular materials on solid surfaces such as paved areas, or provide plywood or sheet materials to prevent mixing with foreign matter.
         (1) Provide surface drainage to prevent flow or ponding of rain water.
         (2) Prevent mixing of refuse or chemically injurious materials with liquids.

4. Arrange storage in manner to provide easy access for inspection.

B. Maintenance of Storage
   1. Maintain periodic system of inspection of stored products on scheduled basis to ensure that:
      a. State of storage facilities is adequate to provide required conditions.
      b. Required environmental conditions are maintained on continuing basis.
      c. Surfaces of products exposed to elements are not adversely affected;
         (1) Any weathering of products, coating and finishes is acceptable under requirements of Contract Documents.
   2. Mechanical and electrical equipment which requires servicing during long term storage shall have complete Manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on exterior of package.
      a. Comply with Manufacturer's instructions on scheduled basis.
      b. Space heaters which are part of electrical equipment shall be connected and operated continuously until equipment is placed in service.

C. Protection After Installation
   1. Provide protection of installed products to prevent damage form subsequent operations. Remove when no longer needed, prior to completion of Work.
   2. Control traffic to prevent damage to equipment and surfaces.
   3. Provide coverings to protect finished surfaces from damage.
      a. Cover projections, wall corners and jambs, sills and soffits of openings in areas used for traffic and for passage of products in subsequent work.
      b. Protect finished doors and stairs from dirt and damage:
         (1) In areas subject to foot traffic, secure heavy paper, sheet goods or other materials in place.
         (2) For movement of heavy products, lay planking or similar materials in place.
         (3) For storage of products, lay tight wood sheathing in place.
         (4) Cover walls and floor of elevator cars, and surfaces of elevator car doors used by construction personnel.
   4. Waterproofed and roofing surfaces:
      a. Prohibit use of surfaces for traffic of any kind, and for storage of any products.
      b. When some activity must take place in order to carry out the Contract, obtain recommendations of installer for protection of surface.
         (1) Install recommended protection, remove on completion of that activity.
         (2) Restrict use of adjacent unprotected areas.
   5. Lawns and Landscaping: Prohibit traffic of any kind across planted lawn and landscaped areas.

2.4 Substitution and Product Options

A. Product Approval Standard
   1. Definitions:
      a. The term **"product"** shall include material, equipment, assembly methods, Manufacturer, brand, trade name, or other description.
      b. References to "approved equal" or similar terms mean that approval of the Architect is required.

   2. Contractor's Options:

a. For products specified only by reference standards, select any product meeting standards, by any Manufacturer.
   (1) Proof of Compliance: Whenever the Contract Documents require that a product be in accord with Federal Specifications, ASTM designation, ANSI Specifications or other association standards, the Contractor shall present an affidavit from the Manufacturer certifying that the product complies therewith. Where requested or specified, submit supporting test data to substantiate compliance.
b. For products specified by naming several products or Manufacturers, select any product and Manufacturer named.
c. For products specified by naming one or more products but indicating the option of selecting equivalent products by stating “or equal” after specified product, Contractor must submit request, as required for substitution, for any product not specifically named.
d. For products specified by naming only one product and Manufacturer, there is no option, and no substitution will be allowed.

B. Availability of Specified Items: Verify prior to bidding that all specified items will be available in time for installation during orderly and timely progress of the Work. In the event specified item or items will not be available, notify the Architect prior to receipt of Bids. Costs or delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back charged as necessary and shall

PART 3 EXECUTION

3.1 Storage of Materials

A. General
1. All Contractors shall confine their equipment, apparatus, storage of materials and operations to limits indicated and shall not bring materials onto the site until needed for the progress of the Work.
2. Storage of materials within the building shall at no time exceed the design carrying capacity of the structural system.
3. The General Contractor shall slot space to other Contractors and subcontractors for storage of their materials, erection of their sheds.
4. The Owner assumes no responsibility for materials stored in building or on the Site. The Contractors assumes full responsibility for damage due to the storing of material.

3.2 Protection

A. General
1. Precaution shall be exercised at all times for the protection of persons, including employees, and property. The safety provisions of applicable laws, building and construction codes shall be observed. Machinery equipment and all hazards shall be guarded or eliminated.
2. Notify Owners of corporate or private property if their property interferes with the Work so the arrangements for proper protection can be made.
3. Provide and maintain proper shoring and bracing to prevent earth from caving or washing into the building excavation. Provide temporary protection around openings through floors and roofs, including elevator openings, stairwells and edge of slabs.

B. Finish Construction
   1. Each Contractor shall assume the responsibility for the protection of all finished construction under this Contract and shall repair and restore any and all damage of finished Work to its original state.
   2. Where responsibility can be fixed, the cost shall be charged to the party responsible. If responsibility cannot be fixed, the cost shall be pro-rated among all Contractors in proportion to their activities at the building at the time the damage was done.
   3. No wheeling of any loads over finished floors, either with or without plank protection will be permitted in anything except rubber tired wheelbarrows, buggies, trucks or dollies. This applies to all finished floors and to all concrete floors exposed as well as those covered with composition tile or other applied surfacing, and shall apply to all Contractors and subcontractors.
   4. Where structural concrete is also the finished surface, care must be taken to avoid marking or damaging those surfaces.

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SECTION 01 70 00 CONTRACT CLOSEOUT

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

INDEX

PART 1 GENERAL

1.1 Description

A. Work Included: Such work as will be necessary to turn the Project over to the Owner in a clean and usable condition. The Work shall include but is not limited to:
   1. Damage repair
   2. Test and adjustments
   3. Punch lists
   4. Warranties
   5. Final waiver of lien
   6. Operation and maintenance instructions
   7. Project record documents

B. Related Work Specified Elsewhere

1. Coordination	Section 01 30 00
2. Shop Drawings, Product Data and Samples	Section 01 33 00
3. Operation and Maintenance Data	Section 01 33 00
4. Cleaning	Section 01 77 16

   5. Closeout Submittals Required of Trades:
      The respective Sections of Specification
   6. Various Sections of these Specifications describe procedures, for individual items, to make finished Construction ready for acceptance by Owner.

C. Work by Owner:

1.2 Quality Assurance

A. The Contractor will promptly make any necessary corrections to the Work as directed by the Architect so as to expedite final payments.

B. Preparation of operating and maintenance data shall be done by personnel:
   1. Trained and experienced in maintenance and operation of the described products.
   2. Completely familiar with requirements of this Section.
   3. Skilled as a technical writer to the extent required to communicate essential data.
   4. Skilled as a draftsperson competent to prepare required Drawings.

1.3 Submittals: The Contractors will submit all warranties, manuals, Drawings, waivers and test reports as required by the various Sections of this Specification to the Owner at the close of the Project.

PART 2 PRODUCTS

2.1 Project Closeout: The Contractors will provide the manpower to promptly close out the Project so that Owner may occupy the building on the date of completion.

PART 3 EXECUTION

3.1 Damage Repair: The Contractors will make final resolution of the repairing of damaged Work.

3.2 Tests and Adjustments: Each Contractor will perform all tests and make all final adjustments under the actual working condition of each piece of equipment. Comply with Manufacturer's recommendations and turn over a complete and workable installation to the Owner.

3.3 Project Record Documents

A. Maintenance of Documents
   1. Maintain at jobsite, one copy of:
      a. Contract Drawings.
      b. Specifications
      c. Addenda
      d. Reviewed Shop Drawings
      e. Change Orders
      f. Other modifications to Contract
      g. Field test records.
   2. Store documents in field office, apart from documents used for construction.
   3. Maintain documents in a clean, dry and legible condition.
   4. Do not use record documents for construction purposes.
   5. Make documents available at all times for inspection by the Architect and Owner.

B. Recording
   1. Label each document "PROJECT RECORD".
   2. Keep record documents current.
   3. Do not permanently conceal any Work until required information has been recorded.
   4. Contract Drawings: Legibly mark to record actual construction.
      a. Depths of various elements of foundation in relation to Floor Level.
      b. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
      c. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
      d. Field changes of dimension and detail.
      e. Changes made by Change Order or Field order.
      f. Details not on original Contract Drawings.
   5. Specifications and Addenda: Legibly mark up each Section to record:
      a. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.

b. Changes made by Change Order or Field Order.
c. Other matters not originally specified.

6. Shop Drawings: Maintain as Record Documents; legibly annotate following Drawings to record changes made after review.

C. Submittals
1. At completion of Project, deliver Record Documents to Architect.
2. Accompany submittal with transmittal letter, in duplicate, containing:
a. Data.
b. Project title and number.
c. Contractor's name and address.
d. Title and number of each record document.
e. Certification that each document is submitted is complete and accurate.
f. Signature of Contractor, or his authorized representative.

3.4 Operating and Maintenance Data

A. General
1. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.
a. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent Sections of Specifications.
2. Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.
3. This portion of these Specifications will be strictly enforced. Final Payment will not be made until all data has been submitted to the Architect. Any money or time spent by the Architect to obtain information from manufacturer shall be deducted from Contractor's final payments.

B. Form of Submittal
1. Prepare data in the form of an instructional manual for use by Owner's personnel.
2. Format:
a. Size: 8-1/2 inch by 11 inch.
b. Text: Manufacturer's printed data, or neatly typewritten.
c. Drawings:
(1) Provide reinforced punched binder tab, bind in with text.
(2) Fold larger Drawings to the size of the text pages.
d. Provide fly-leaf for each separate product, or each piece of operating equipment.
(1) Provide typed description of product and major component parts of equipment.
(2) Provide indexed tabs.
e. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
(1) Title of Project
(2) Identity of general subject matter covered in the Manual.
f. In addition to paper copies of O&M data, provide 3 electronic copies with all information in .pdf format. Each division with the .pdf file shall be bookmarked if multiple sections are included in one file.
3. Binders: Commercial quality three-ring binders with durable and cleanable plastic covers.

C. Content of Manual
   1. Neatly typewritten table of contents for each volume, arranged in a systematic order.
      a. Contractor, name of responsible principal, address and telephone number.
      b. A list of each product required to be included, indexed to the content of the volume.
      c. List, with each product, the name, address and telephone number of:
         (1) Subcontractor or installer.
         (2) Maintenance contractor, as appropriate.
         (3) Identify the area of responsibility of each.
         (4) Local source of supply for parts and replacement.
      d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
   2. Product Data:
      a. Include only those sheets which are pertinent to the specific product.
      b. Annotate each sheet to:
         (1) Clearly identify the specific product or part installed.
         (2) Clearly identify the data applicable to the installation.
         (3) Delete references to inapplicable information.
   3. Drawings:
      a. Supplement product data with Drawings as necessary to clearly illustrate:
         (1) Relations of component parts of equipment and systems.
         (2) Control and flow diagrams.
      b. Coordinate Drawings with information in Project Record Documents to assure correct illustration of completed installation.
      c. Do not use Project Record Documents as maintenance Drawings.
   4. Written text, as required, to supplement product data for the particular installation:
      a. Organize in a consistent format under separate headings for different procedures.
      b. Provide a logical sequence of instructions for each procedure.
   5. Copy of each warranty, bond and service contract issued;
      a. Provide information sheet for Owner's personnel, give:
         (1) Proper procedures in the event of failure.
         (2) Instances which might affect the validity of warranties or bonds.

D. Manual for Materials and Finishes
   1. Submit two copies of complete manual in final form.
   2. Content, for architectural products, applied materials and finishes.
      a. Manufacturer's data, giving full information on products.
         (1) Catalog number, size, composition.
         (2) Color and texture designations.
         (3) Information required for re-ordering special-manufactured products.
      b. Instructions for care and maintenance.
         (1) Manufacturer's recommendation for types of cleaning agents and methods.
         (2) Cautions against cleaning agents and methods which are detrimental to the product.
         (3) Recommended schedule for cleaning and maintenance.
   3. Content, for moisture-protection and weather-exposed products:
      a. Manufacturer's data, giving full information on products.
         (1) Applicable standards.
         (2) Chemical composition.
         (3) Details of installation.

b. Instructions for inspection, maintenance and repair.

4. Additional requirements for maintenance data: The respective Sections of Specifications.

E. Manual for Equipment and Systems
1. Submit three copies of complete manual in final form.
2. Content, for each unit of equipment and system, as appropriate:
   a. Description of unit and component parts.
      (1) Function, normal operating characteristics, and limiting conditions.
      (2) Performance curves, engineering data and tests.
      (3) Complete nomenclature and commercial number of all replaceable parts.
   b. Operating procedures:
      (1) Start-up, break in, routine and normal instructions.
      (2) Regulation, control, stopping, shut-down and emergency instructions.
      (3) Summer and winter operating instructions.
   c. Maintenance procedures:
      (1) Routine operations.
      (2) Guide to “trouble-shooting”.
      (3) Disassembly, repair and reassembly.
   d. Servicing and lubrication schedule.
      (1) List of lubricants required.
   e. Manufacturer’s printed operating and maintenance instructions.
   f. Description of sequence of operation by control Manufacturer.
   g. Original Manufacturer’s parts list, illustrations, assembly drawings and diagrams required for maintenance.
      (1) Predicted life of parts subject to wear.
      (2) Items recommended to be stocked as spare parts.
   h. As-installed control diagrams by controls Manufacturer.
   i. Each Contractor’s coordination Drawings;
      (1) As-installed color coded piping diagrams.
   j. Charts of valve tag numbers, with the location and function of each valve.
   k. List of original Manufacturer’s spare parts, Manufacturer’s current prices, and recommended quantities to be maintained in storage.
   l. Other data as required under pertinent Sections of Specifications.
3. Content, for each electric and electronic system, as appropriate:
   a. Description of systems and component parts.
      (1) Function, normal operating characteristics, and limiting conditions.
      (2) Performance curves, engineering data and tests.
      (3) Complete nomenclature and commercial number of replaceable parts.
   b. Circuit directories of panelboards.
      (1) Electrical service.
      (2) Controls.
      (3) Communications.
   c. As-installed color coded wiring diagrams.
   d. Operating procedures:
      (1) Routine and normal operating instructions.
      (2) Sequences required.
      (3) Special operating instructions.
   e. Maintenance procedures:
      (1) Routine operations.
      (2) Guide to “trouble-shooting”.

(3) Disassembly, repair and reassembly.
(4) Adjustment and checking.
f. Manufacturer's printed operating and maintenance instructions.
g. List of original Manufacturer's spare parts, Manufacturer's current prices, and recommended quantities to be maintained in storage.
h. Other data as required under pertinent Sections of Specifications.
4. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
5. Additional requirements for operating and maintenance data:
The respective Section of Specifications.
6. Provide complete information for products specified in:

F. Submittal Schedule: Submit specified number of copies or approved data in final form ten (10) days after final inspection or acceptance.

G. Instruction of Owner's Personnel
1. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment and systems.
2. Operating and maintenance manual shall constitute the basis of instruction;
a. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

3.5 Warranties and Bonds

A. General
1. Compile specified warranties and bonds.
2. Compile specified service and maintenance contracts.
3. Co-execute submittals when so specified.
4. Review submittals to verify compliance with Contract Documents.
5. Submit to Architect for review and transmittal to Owner.

B. Submittal Requirements
1. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.
2. Number of original signed copies required: Two each.
3. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.
a. Product or work item.
b. Firm, with name of principal, address and telephone number.
c. Scope.
d. Date of beginning of warranty, bond or service and maintenance contract.
e. Duration or warranty, bond or service maintenance contract.
f. Provide information for Owner's personnel:
(1) Proper procedure in case of failure.
(2) Instance which might affect the validity of warranty or bond.
g. Contractor, name of responsible principal, address and telephone number.

C. Form of Submittals
1. Prepare in duplicate packets.
2. Format:

a. Size 8-1/2 inches by 11 inches, punch sheets for 3-ring binder;
   (1) Fold larger sheets to fit into binders.
b. Cover: Identify each packet with typed or printed title “WARRANTIES AND BONDS”. List:
   (1) Title of Project.
   (2) Name of Contractor.
c. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.
d. CD/Flash drive three (3) of all documents.

D. Time of Submittals
   1. For equipment or component parts of equipment put into service during progress of construction:
      a. Submit documents within ten (10) days after inspection and acceptance.
   2. Otherwise, make submittals within ten (10) days after Date of Substantial Completion prior to final request for payment.
   3. For items of Work, where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within ten (10) days after acceptance, listing the date of acceptance as the start of the warranty period.

E. Submittals Required: Submit warranties, bonds, and service and maintenance contracts as specified in the respective Sections of Specifications.

3.6 Punch Lists

A. Prior to substantial completion, the Architect will inspect the project and publish all items of the Work found unacceptable in the form of a Punch List. The Work described should be done immediately and the Punch List returned to the Architect with each item initialed and dated. The Contractors should not use the Punch List as a final inspection service because of their own lack of quality control.

B. Contractor will, within seven (7) days of issuance of Punch List by Architect, provide, in writing, to the Architect a Schedule of Completion for the Punch List items.

3.7 Substantial Completion

A. When Contractor considers the Work is substantially complete, they shall submit to Architect:
   1. A written notice that the Work, or designated portion thereof, is substantially complete.
   2. A list of items to be completed or corrected.
B. Within a reasonable time after receipt of such notice, Architect will make an inspection to determine the status of completion.

C. Should Architect determine that the Work is not substantially complete:
   1. Architect will promptly notify the Contractor, in writing, giving the reasons therefore.
   2. Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Architect.
   3. Architect will reinspect the Work.

3.8 Final Inspection

A. When Contractor considers the Work is complete, he shall submit written certification that:
   1. Contract Documents have been reviewed.
   2. Work has been inspected for compliance with Contract Documents.
   3. Work has been completed in accord with Contract Documents.
   4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
   5. Work is completed and ready for final inspection.

B. Architect will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should Architect consider that the Work is incomplete or defective:
   1. Architect will promptly notify the Contractor in writing, listing the incomplete or defective work.
   2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Architect that the Work is complete.
   3. Architect will reinspect the Work.

D. When the Architect finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

3.9 Reinspection Fees

A. Should Architect perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:
   1. Owner will compensate Architect for such additional services.
   2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

3.10 Contractor's Closeout Submittals to Architect: Documents required prior to Final Payment: Prior to final payment, and before the issuance of final certificate for payment the following items must be filed with the Architect:

A. Evidence of compliance with requirements of governing authorities:
   1. Certificates of Inspection
      a. Elevators
      b. Mechanical
      c. Electrical
B. Project Record Documents: to requirements of Section 01 70 00.

C. Operating and Maintenance Data, Instructions to Owner's Personnel: to requirements of Section 01 70 00.

D. Warranties and Bonds: to requirements of Section 01 70 00.

E. Keys and Keying Schedule: to requirements of Section 08 71 00, Finish Hardware.

F. Spare Parts and Maintenance Materials: Attic stock is required by the various Sections of these Specifications include, but are not necessarily limited to the table below.

G. Final Waiver of Lien: To indicate that all debts and claims against this Project have been paid in full or otherwise satisfied, and to give final evidence of release of all liens against the Project and its Owner, the Contractors shall submit a certification to that effect.

H. Provide the Architect with a written statement that the Owner's maintenance personnel have received operation and maintenance manuals and have received complete instructions on the operation of all equipment under every possible condition.

I. Certificate of Insurance for Products and Completed Operations.

3.11 Final Adjustment of Accounts

A. Submit a final statement of accounting to the Architect.

B. Statement shall reflect all adjustments to the Contract Sum:
   1. The original Contract Sum.
   2. Additions and deductions resulting from:
      a. Previous Change Orders.
      b. Unit Prices.
      c. Deductions for uncorrected work.
      d. Deductions for reinspection payments.
      e. Other adjustments.
   2. Total Contract Sum, as adjusted.
   3. Previous payments.
   4. Sum remaining due.

C. Architect will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

3.12 Final Application for Payment

A. Contractor shall submit the final Application for Payment in accord with procedures and requirements stated in the Conditions of the Contract.

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SECTION 01 73 29 CUTTING AND PATCHING

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

INDEX

PART 1 GENERAL

1.1 Description

A. Related Requirements Specified Elsewhere
   1. General Conditions
      a. Cutting and patching of Work
      b. Tests
      c. Uncovering and correction of Work
   2. Coordination — Section 01 30 00
   3. General Provisions, Electrical Section — Division 26

B. Execute Cutting (including excavating), Fitting or Patching of Work, required to:
   1. Make several parts fit properly.
   2. Uncover Work to provide for installation of ill-timed work.
   3. Remove and replace defective Work.
   4. Remove and replace work not conforming to requirements of Contract Documents.
   5. Remove samples of installed Work as specified for testing.
   6. Install specified Work in existing construction.
   7. To receive the Work of other contractors as shown or reasonably implied by the Drawings or Specifications

C. In addition to Contract requirements, upon written instructions of Architect:
   1. Uncover work to provide for Architect's observation of covered work.
   2. Remove samples of installed materials for testing.
   3. Remove work to provide for alteration of existing work.

D. Do not endanger any Work by cutting or altering work or any part of it.

E. Do not cut or alter Work of another Contractor without written consent of Architect.

1.2 Submittals

A. Prior to cutting which affects structural safety of Project, or Work of another Contractor, submit written notice to Architect, requesting consent to proceed with cutting, including:
   1. Identification of project.
   2. Description of affected Work.
   3. Necessity for cutting.
   4. Effect on other Work, on structural integrity of Project.
   5. Description of proposed work – designate:
      a. Scope of cutting and patching.

b. Contractor and trades to execute work.
c. Products proposed to be used.
d. Extent of refinishing.

6. Alternatives to cutting and patching.
7. Designation of party responsible for cost of cutting and patching.

B. Prior to cutting and patching done on instruction of Architect, submit cost estimate.

C. Should conditions of work, or schedule, indicate change of materials or methods, submit written recommendation to Architect, including:
1. Conditions indicating change.
2. Recommendations for alternative materials or methods.
3. Submittals as required for Substitutions.

D. Submit written notice to Architect, designating time Work will be uncovered, to provide for observation.

1.3 Payment for Costs

A. Costs caused by ill-timed or defective Work or Work not conforming to Contract Documents, including cost for additional services of Architect: Party responsible for ill-timed, rejected or nonconforming work.

B. Work done on instructions of Architect, other than defective or nonconforming work: Owner.

C. Work caused by the damage of a Contractor's installation or equipment by another Contractor: Contractor responsible for causing the damage.

PART 2 PRODUCTS

2.1 Materials: For replacement of Work removed, comply with Specifications for type Work to be done.

PART 3 EXECUTION

3.1 Inspection

A. Inspect existing conditions of Work, including elements subject to movement or damage during:
1. Cutting and patching
2. Excavating and backfilling.

B. After uncovering Work, inspect conditions affecting installation of new products.

3.2 Preparation Prior to Cutting

A. Provide shoring, bracing and support as required to maintain structural integrity of Project.

B. Provide protection for other portions of Project.

3.3 Performance

A. Each prime Contractor will arrange for all cutting and patching, for their portion of the Work. Hire only skilled workmen qualified in the type of work required.

B. Each Prime Contractor will be expected to cut, bore, drill, etc. through all materials as required including concrete, steel and wood.

C. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances, finishes.

D. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation or repairs and new work.

E. Execute excavating and backfilling by methods which will prevent damage to other work, and will prevent settlement.

F. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of Contract Documents.

G. Refinish entire surfaces as necessary to provide an even finish.
   1. Continuous Surfaces: to nearest intersections.
   2. Assembly: entire refinishing.

H. The painting Contractor will be responsible for repairing all damage to their work under this Specification.

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SECTION 01 77 16 PROGRESS CLEANING AND FINAL CLEANING

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern Work under this Section.

INDEX

PART 1 GENERAL

1.1 Description

A. Work Included
   1. Throughout the construction period, maintain the building, the site and adjacent private and public property in a standard of cleanliness as described in this Section.
   2. It shall be the duty of each Prime Contractor to keep the premises free of accumulations of surplus materials and rubbish caused by his operations and the operations of this subcontractors unless otherwise stated.

B. Related Work Specified Elsewhere
   1. General Conditions
      a. Cleaning up
      b. Owner's right to clean-up
   2. Coordination — Section 01 30 00
   3. Project Closeout — Section 01 70 00
   4. Cutting and Patching — Section 01 73 29
   5. In addition to standards described in this Section, comply with all requirements for cleaning up as described in various other Sections of these Specifications.

1.2 Quality Assurance

A. Inspection: Conduct daily inspections, and more often if necessary, to verify that requirements of cleanliness are being met.

B. Codes and Standards: In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

PART 2 PRODUCTS

2.1 Cleaning Materials and Equipment: Provide all required personnel, equipment and materials needed to maintain the specified standards of cleanliness.

2.2 Compatibility: Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Architect.

2.3 Containers: Each Contractor for the General Work will provide metal containers for storage of rubbish which will be used by all persons working for that contractor.

PART 3 EXECUTION

3.1 Progress Cleaning

A. General
1. Retain all stored items in an orderly arrangement allowing maximum, not impeding drainage or traffic, and providing the required protection of materials.
2. Do not allow the accumulation of scrap, debris, waste material and other items not required for construction of this work.
3. At least twice each month, and more often if necessary, completely remove all scrap, debris and waste material from the job site and legally dispose of at public or private dumping areas off Owner's propriety.
4. The General Contractor will assign adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.
5. No burning of rubbish or debris will be allowed at site. No rubbish shall be thrown through openings or from heights without proper protection.
6. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
7. The General Contractor will vacuum-clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as needed basis until building is ready for substantial completion or occupancy.
8. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
9. The General Contractor shall perform a broom cleaning of all appropriate surfaces, each Friday afternoon.

B. Safety Requirements
1. Hazards Control
   a. Store volatile wastes in covered metal containers, and remove from premises daily.
   b. Prevent accumulation of wastes which create hazardous conditions.
   c. Provide adequate ventilation during use of volatile or noxious substances.
   d. Keep work areas, passageways, ramps, stairs, free of debris and scrap.
   e. Form and scrap lumber shall have nails withdrawn or bent over and lumber shall be stacked or removed.
   f. Remove spills of oil, grease or other liquids immediately or sprinkle with sand.
2. Conduct cleaning and disposal operation to comply with local ordinances and anti-pollution laws.
   a. Do not bury rubbish and waste materials on project site.
   b. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.
   c. Do not dispose of wastes into streams or waterways.

C. Site
1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris and waste material. Remove all such items to the place designated for their storage.
2. Weekly, and more often if necessary, inspect all arrangements of materials stored on the site, restack, tidy or otherwise service all arrangements to meet the requirements of Paragraph 3.1-A-1 above.
3. Maintain the site in a neat and orderly conditions at all times to the approval of the Architect.

D. Structures
   1. Weekly, and more often if necessary, each prime contractor will inspect the structures and pick up all their scrap, debris and waste material. Remove all such items to the place designated for their storage.
   2. Weekly, and more often if necessary, the General Contractor will sweep all interior spaces clean. “Clean”, for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by reasonable diligence using a hand-held broom.
   3. As required preparatory to installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.
   4. Following the installation of finished floor materials, the General Contractor will clean the finished floor daily (and more often if necessary) at all times while work is being performed in the space in which finish materials have been installed. “Clean”, for the purpose of this subparagraph, shall be interpreted as meaning free form all foreign material which, in the opinion of the Architect, may be injurious to the finish floor material.
   5. Daily cleanup, within all Owner occupied areas in which work has occurred, will be the responsibility of the Contractor doing the work.

E. Graffiti: As directed by the Architect, the General Contractor will promptly remove all evidence of graffiti within the limits of the site.

F. Disputes Over Responsibility for Cleaning: If, during the course of construction, disputes should arise over which parties are responsible for cleaning all or a portion of the work, the Architect will require each prime contractor, working at the site, to supply one employee for a clean-up crew, which will be under the direction of the General Contractor.

3.2 Final Cleaning

A. Definition: Except as otherwise specifically provided, “Clean” (for the purpose of this Article) shall be interpreted as meaning the level of cleanliness generally provided by commercial quality building maintenance equipment and materials. Employ experienced workers, or professional cleaners, as approved by the Owner, for final cleaning.

B. General: Prior to completion of the Work, all Contractors will remove from the job site all tools, surplus materials, equipment, scrap, debris and waste. Conduct final progress cleaning as described in Article 3.1 above.

C. Site: Unless otherwise specifically directed by the Architect, the General Contractor will hose down all paved areas on the site and all public sidewalks directly adjacent to the site.
   Completely remove all resultant debris. Rake clean other surfaces of grounds. Remove snow and ice from access to building.

D. Structures
   1. Exterior: The General Contractor will visually inspect all exterior surfaces and remove all traces of soil, waste material, smudges and other foreign matter. Remove

all traces of splashed materials from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure. In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning, by the responsible Contractor, at no additional cost to the Owner.

2. Interior: The General Contractor will visually inspect all interior surfaces and remove all traces of soil, waste material, smudges and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. Remove all paint droppings, spots, stains and dirt from finished surfaces. Use only the specified cleaning materials equipment. Stubborn stains will be removed by the responsible Contractor at the direction of the Architect.
3. Electrical Fixtures (Electrical Contractor)
   a. Lenses and louvers should be free of dirt and dust.

E. Timing
1. Schedule final cleaning as approved by the Architect to enable the Owner to accept a completely clean project.
2. The General Contractor will notify all prime contactors of the dates for the final cleaning of the building. After those dates, but prior to issuance of the prefinal inspection Punch List, any soiling of cleaned areas will be cleaned by the responsible Contractor or cleaned by the General Contractor and charged to the responsible Contractor.
3. After issuance of the prefinal inspection Punch List, recleaning will be done by the responsible Contractor or cleaned by the General Contractor or Owner and charged to the responsible Contractor.
4. Maintain cleaning until Project, or portion thereof, is occupied by Owner.

3.3 Cleaning During Owner's Occupancy: Should the Owner occupy the work, or any portion thereof, prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning of the occupied spaces shall be determined by the Architect in accord with the General Conditions of Contract.

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SECTION 03 30 00 CAST-IN-PLACE CONCRETE

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX

PART 1 GENERAL

1.1 Description

A. Work Included: Cast-in-place concrete required for this work (including forms and reinforcing) is indicated on the drawings and includes but is not necessarily limited to:
   1. Exterior flat work

B. Related Work Specified Elsewhere
   1. Structural Steel Framing — Section 05 50 00

1.2 Quality Assurance

A. Workers: Use only workers experienced in the placing and finishing of concrete and erecting of reinforcing.

B. Codes and Standards: Concrete work shall conform to all requirements of ACI 301-16, Specifications for Structural Concrete, except as modified by the Supplemental Requirements below:
   1. A copy of ACI-301-16, Specifications for Structural Concrete for Buildings is on file at the office of the Architect. The Contractor in submitting a proposal verifies that they have complete knowledge of ACI 301-16. A copy of ACI 301 shall be bound into the copy of the building Specifications and kept on the site during construction. All concrete work will also conform to ACI 318-14 Building Code Requirements for Structural Concrete.

1.3 Submittals: At award of Contract and before any concrete is delivered to the job site submit to the Architect in accordance with these Specifications: Reinforcing steel drawings and Mix designs.

PART 2 PRODUCTS

2.1 Supplemental Requirements: Numbers listed below correspond to numbering designations used in ACI 301-16, Specifications for Structural Concrete for Buildings.

(1.6) Testing: Take test cylinders as directed by Architects for testing by Owner.

(2.2.1.4) Joint at perpendicular filler to meet Article 2.2.1.4

(3.2) Reinforcing steel:
3.2.1.1 Deformed bars grade: ASTM A615 Grade 60, new billet steel.
3.2.1.5 Wire grade: ASTM A1064.

(3.3.2.5) Welded Wire Fabric: Welded wire fabric shall be as specified on the drawings. Fabric to be supplied in sheets; rolled goods are not permitted. Fabric to be supported on chairs to position the wires at the specified height. “Hooking” during concrete placement is not permitted.

(4.2.1.4) Admixtures: Air entraining admixtures compliant with ASTM C260 in accord with ACI 301 will be acceptable. Chemical admixtures compliant with ASTM C 494 or ASTM C 1017 in accord with ACI 301 will be acceptable / Chemical (non-chloride) admixtures compliant with ASTM C 494 or ASTM C 1017 in accord with ACI 301 will be acceptable.

(4.2.2) Concrete Strength: All concrete - 4000 psi at 28 days.

(4.2.2.2) Maximum slumps as follows: Slump shall be 4” per ACI 301 with a tolerance of +/- 1” per ACI 117. As stated in ACI 301, plasticizing admixtures will increase the allowable slump. Expected slump shall be documented on the mix design.

(4.2.2.4) Concrete for foundation walls and exterior slabs shall be classified as Exposure Class F2.

(5.3.1) Placing: Notify Architect 24 hours in advance of starting time of each pour. Allow time for inspection of forms, reinforcement, screeds, etc., and to explain procedures for slump and cylinder tests.

(5.3.3.3) As-cast finishes:
5.3.3.3.b Smooth form finish required.

(5.3.3.4.a) Smooth rubbed finish on exposed sections of retaining walls, exposed foundations and curbs. Remove form marks prior to application. Commercial coating as approved by Architect.

(5.3.4.2) Tolerances: Concrete to be true to plane, plumb and level with true curves. Deviations from dimensions, pitches, contours may not exceed 1/4" when by adding to scratch coat this may be corrected. Deviations which require a reduction in total two inch thickness of tile and setting bed, as shown on the Drawings will not be allowed.

(5.3.5) Control Joints: saw cut or trowel as shown on plan or max size 14'-0" x 14'-0"; curbing at 10'-0” o.c.

(5.3.6) Concrete Surface Sealer: At all slabs to remain exposed and noted as “Sealer” on Room Finish Schedule,

Lapidolith by Sonneborn
Aquapel by L&M Construction Chemicals.

Apply per manufacturer’s specifications for new concrete immediately after finishing.

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SECTION 05 50 00 METAL FABRICATIONS

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX

PART 1 GENERAL

1.1 Description

A. Work Included: Metal fabrications required for this work are indicated on the Drawings and include, but are not necessarily limited to:
   1. Pipe Bollards

B. Related Work Specified Elsewhere

1. Cast-In-Place Concrete	Section 03 30 00
2. Finish Painting	Section 09 91 00

C. Work Furnished but Not Installed

1. Metal fabrications cast in concrete	Section 03 30 00

1.2 Quality Assurance

A. Qualifications
   1. Fabricator: Fabricator shall have not less than 5 years experience in the fabrication of metal fabrications.
   2. Welding: All welding shall be performed by operators who have been recently qualified as prescribed in "Qualification Procedure" of the American Welding Society.

B. Requirements of Regulatory Agencies: In addition to complying with all pertinent codes and regulations, comply with:
   1. "Code for Welding in Building Construction" of the American Welding Society.
   2. Specifications for Structural Joints Using ASTM A-325 or A-490 Bolts, approved by the Research Council on Riveted and Bolted Joints of the Engineering Foundation.
   3. Specifications of the Structural Steel Painting Council.
   4. Applicable Building Code. All railings to meet requirements.
   5. In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards or these Specifications, the provisions of the more stringent shall govern.

C. Source Quality Control: Inspection of shop welds shall be in accord with Section 6 of AWS Building Code.

D. Reference Standards
   1. American Society for Testing and Materials (ASTM):

a. A 36, Structural Steel
b. A 325, High Strength Bolts for Structural Steel Joints Including Suitable Nuts and Plain Hardened Washers.
c. A 501, Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
d. F 1554, Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

2. American Welding Society (AWS)
   a. D 1.1, Structural Welding Code.
3. Federal Specifications (FS):
   a. TT-P-645, Primer, Paint Zinc Chromate, Alkyd Type.
4. Structural Steel Painting Council (SSPC)
   a. Paint 13, Number 13 Red or Brown One-Coat Shop Paint.

1.3 Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Architect in accordance with these Specifications; the following:

A. Shop Drawings: Show all shop and erection details including cuts, copes, connections, holes, threaded fasteners, rivets, and welds. All welds, both shop and field, shall be indicated by AWS "Welding Symbols" A 2.0. Indicate all required field measurements.

B. Maintenance Instruction: Procure from manufactures of exposed metals, recommendations describing procedures for maintaining, including cleaning materials, application methods and precautions as to use of materials which may be detrimental to finish when improperly applied.

1.4 Product Delivery, Storage and Handling

A. Protection: Use all means necessary to protect metal fabrications before, during and after installation and to protect the installed work and materials of all other trades.

B. Delivery of Materials to be Installed Under Other Sections:
   1. Anchor bolts and other anchorage devices which are embedded in cast-in-place concrete or masonry construction shall be delivered to the project site in time to be installed before the start of cast-in-place concrete operations or masonry work.
   2. Provide setting drawings, templates, and directions for the installation of the anchor bolts and other devices.

C. Storage of Materials
   1. Metal fabrications which are stored at the project site shall be above ground on platforms, skids or other supports.
   2. Steel shall be protected from corrosion.
   3. Other materials shall be stored in a weather tight and dry place, until ready for use in the work.
   4. Packaged materials shall be stored in their original unbroken package or container.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 Materials

A. Steel: ASTM A 36.

B. Bolts, Nuts and Washers: High strength type recommended for structural steel joints; ASTM A 325.

C. Welding Materials: Applicable AWS D1.1, type required for materials being welded.

D. Anchor Bolts: conform to ASTM F-1554 - 36.

E. Steel Bar and Tube
   1. Carbon Steel Bar
      a. Shape: round, square or rectangular
      b. ASTM A 29
   2. Carbon Steel Tube
      a. Shape: round, square or rectangular
      b. ASTM A 501
   3. Fittings
      a. Carbon Steel: ASTM A 36, 1010 low carbon plate.
      b. Lead: FS QQ-C-40, type I grade AA, form ingots.
      c. Machine screws: FS FF-S-92, type III style 2c.
      d. Cement: Hydraulic, quick-setting, ASTM C 595, factory prepared with accelerator.

F. Shop Paint Primer: Standard primer: SSPC Paint 13.

G. Galvanized Coating: For materials called out as ‘galvanized’, provide G-90 hot-dipped coating per ASTM A-123.

H. Other Materials: All other materials, not specifically described but required for a complete and proper installation of metal fabrications, shall be new, free from rust, first quality of their respective kinds, and subject to the approval of the Architect. Fabricate and supply to concrete or masonry subcontractor all cast-in weld plates to anchor railings. See Drawings for toe guards.

2.2 Fabrication

A. Fabricate metal fabrications in accord with the Shop Drawings and reference standards with the modifications and additional requirements specified in this Section. Fabricate items with joints nearly fitted and properly secured. Fit and shop assemble in largest practical sections, for delivery to site.

B. Connections:
   1. Shop Connections: Welded or bolted.
   2. Field Connections:
      a. Provide bolted connections as follows:
         (1) High strength threaded fasteners shall be used for bolted connections, except where standard threaded fasteners are permitted.
         (2) High strength bolted construction assembly: tightening shall be done in accord with Section 5 RCSC of Specifications for Structural Joints.
         (3) Fabricator is responsible for design and strength of connections unless otherwise noted on the Drawings.

3. Exposed Mechanical Fastenings: Flush countersunk screws of bolts unobtrusively located consistent with design of structure, except where specifically noted otherwise.
4. Make exposed joints flush butt type hair line joints where mechanically fastened.
5. Supply components required for proper anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, unless otherwise specified.

C. Holes:
1. Punch holes as required for connection of other work per templates and directions of such trades.
2. Steel requiring accurate alignment shall be provided with slotted holes and shims for trueing up steel, as required for alignment.

D. Welded Construction:
1. Welding process shall be limited to one or a combination of the following:
   a. Manual shielded-arc
   b. Submerged arc
   c. Gas metal-arc
   d. Flux cored arc
   e. Electroslag
   f. Electrogas
2. Welded assemblies shall be stress relieved by heat treatment.
3. Use equipment which will supply proper current in order that operator may produce satisfactory welds. Welding machine: 200 to 400 amperes, 25-40 volts capacity.
4. Field welding: by direct current. Remove paint within two inches of weld.
5. Grind exposed welds smooth and flush with adjacent finished surface.

E. Shop Painting: Shop paint all steel work unless noted as ‘galvanized’.

PART 3 EXECUTION

3.1 Surface Conditions

A. Inspection
1. Prior to installation of the Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that metal fabrications may be fabricated and erected in strict accord with the original design, the approved Shop Drawings and the reference standards.

B. Discrepancies
1. In the event of discrepancy, immediately notify the Architect.
2. Do not proceed with fabrication or installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 Preparation

A. Field Measurements: Take field measurements to verify or supplement dimensions. Be responsible for accurate fit of all work.

3.3 Erection

A. Field Assembly
   1. Metal fabrications shall be accurately assembled to the lines and elevations indicated, within the specified erection tolerances.
   2. The various members forming parts of a complete frame or structure after being assembled shall be aligned and adjusted accurately before being fastened.
   3. Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled.
   4. Provide temporary bracing as necessary, and leave in place as long as may be required.
   5. Obtain Architect's review prior to site cutting or making adjustments, which are not part of scheduled work.
   6. After installation, touch-up field welds and scratches and damaged. Use a primer consistent with shop coat.

3.4 Cleaning

A. Metals to receive paint
   1. Wash thoroughly using clean water and soap; rinse with clean water.
   2. Do not use acid solution, steel wool or other harsh abrasive.
   3. If stain remains after washing, remove finish and restore in accord with recommendations of fabricator.

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SECTION 09 91 00 PAINTING

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX

PART 1 GENERAL

1.1 Description

A. Work Included
1. The Painting Contractor shall furnish all material, labor and equipment required to complete all painting and finishing as shown on the Drawings, Plans and Specifications.
2. The Painting Contractor shall examine the Specifications for the various other trades and shall thoroughly become familiar with all provisions regarding painting. All surfaces that are left unfinished by the requirements of other Specifications shall be painted or finished as a part of this Work.
3. In general, paint all wood, metal surfaces, doors, frames, masonry; omit acoustic tile, aluminum and prefinished wood doors.
4. Following Specifications cover complete painting, finishing of wood and other surfaces throughout interior and exterior of building, unless otherwise noted.
5. Painting Contractor will include in his Bid the Painting of all cabinetwork and millwork supplies as part of the Millwork Contractor's Bid.
6. The types of paint to be used and the number of coats to be applied are listed in the Painting Schedule in Part 3.6 of this Section of these Specifications.
7. Furnish tools, ladders, scaffolding, other equipment necessary for work completion.

B. Related Work Specified Elsewhere
1. Prefinishing: Shop priming and factory prefinishing are required on some, but not all of the items described in other Sections of these Specifications.
2. Structural Steel, Miscellaneous Metals; one shop coat and touching up in field.

C. Definitions
1. The term "Paint", as used herein, includes enamels, paints, sealers, fillers, emulsions, and other coatings, whether used as prime, intermediate of finish coats.
2. "Coats" described later are based on roller, brush or spray application. Above does not refer to processes that require spraying only for their application or where specifically specified to be sprayed.
3. Conform to ASTM D16 for interpretation of terms used in this Section.

1.2 Quality Assurance

A. Qualifications of Painters
   1. Maintain a crew of painters throughout the duration of the work who shall be qualified to fully satisfy the requirements of this Specification.
   2. Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Apprentices may be employed to work under the direction of qualified journeymen, in accord with trade regulations. In the acceptance or rejection of installed painting, no allowance will be made for lack of skill on the part of painters.

B. Requirements of Regulatory Agencies
   1. Occupational Safety and Health and pollution Regulations: Conform to the Federal and State requirements for painting work applicable to this Project.
   2. Permits: Obtain and pay for any special permits required by local governmental agencies.

C. Reference Standards
   1. American Society for Testing and Materials (ASTM):
      a. D 16, Definitions of Terms Relating to Painting, Varnish, Lacquer and Related Products.
   2. In addition to complying with all pertinent codes and regulations, comply with "Standard (Type 1)" as defined by the Painting and Decorating Contractors of America in their "Modern Guide to Paint Specifications", current Edition.

D. Coatings Maintenance Manual
   1. Upon conclusion of the project and request, the contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as PPG “Maintenance Binder”. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.3 Submittals: Within 35 days after award of Contract, and before any of the materials of this Section are delivered to the job site, submit complete to the Owner in accordance with these Specifications; the following:

A. Samples: Accompanying the materials list, submit to the Owner two copies of the full range of colors, textures and finishes available in each of the proposed products.

B. Manufacturer's Recommendations: In each case where material proposed is not the material specified or specifically described as an acceptable alternate in this Section of these Specifications, submit for the Owner's review the current Manufacturer of the proposed material.

C. Material List
   1. A complete list of all materials proposed to be furnished and installed under this portion of the Work.
   2. This shall in no way be construed as permitting substitution of materials for those specified or approved for this Work by the Owner.

D. Color Charts: Include color charts for selection by Owner.

1.4 Product Delivery, Storage and Handling

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Delivery of Materials: Deliver all paint materials to the job site in their original unopened containers with all labels intact and legible at time of use.

C. Storage of Materials
   1. Store only the approved materials at the job site, and store only in suitable and designated area restricted to the storage of paint materials and related equipment.
   2. Use all means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste.
   3. Store paint materials at minimum ambient temperature of 45 degrees F. and a maximum of 90 degrees F., in well ventilated area, unless required otherwise by Manufacturer's instructions.

D. Handling Materials and Equipment
   1. Take precautionary measures to prevent fire hazards and spontaneous combustion.
   2. All soiled or used rags, waste and trash must be removed from the building each night and every precaution taken to avoid the danger of fire.
   3. Toxic Materials:
      a. Where toxic materials, including both toxic and explosive solvents are used, take appropriate precautions as a regular procedure, conforming to the Manufacturer's recommendations and to the requirements of the applicable safety regulatory agencies.
      b. In applying acid etch coating or solutions and toxic materials, provide ventilation and take protective measures to conform to the requirements of regulatory agencies.

E. Replacements: The painting trade is responsible for making repairs of their own Work when due to defective workmanship or materials. Repair of damaged paint finish caused by other trades will be done by this Contractor but paid for by the contractor causing such damage.

1.5 Job Conditions

A. Environmental Requirements
   1. Comply with Manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
   2. Do not apply finish in areas where dust is being generated.
   3. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F. for 24 hours before, during and for 48 hours after application of finishes, unless required otherwise by Manufacturer's instructions.
   4. Do not apply exterior coatings during rain or snow or when relative humidity is above 50 percent, unless required otherwise by Manufacturer's instructions.
   5. Minimum Application Temperatures for Latex Paints: 45 degrees F. for interiors; 50 degrees F. for exteriors; unless required otherwise by Manufacturer's instructions.

6. Minimum Application Temperature for Varnish Finishes: 65 degrees F. for interior, unless required otherwise by Manufacturer's instructions.
7. Provide lighting level of 80 foot candles measured mid-height at substrate surface.
8. Do not do exterior work on unprotected surfaces if it is raining or moisture from any other source is present or expected before applied materials can dry or attain proper cure.
9. Allow surfaces wetted by rain or other moisture source to dry and to attain temperatures and conditions specified before proceeding or continuing with coating application.

B. Protection
1. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.
2. The Painting Contractor shall protect surfaces and objects inside and outside the building, as well as the grounds, lawns, shrubbery and adjacent properties against damage. The Painting Contractor shall be held responsible for damage to adjacent furnishings.
3. Drop Cloths: Provide sufficient drop cloths, shields and protective equipment to prevent spray or drippings from fouling surfaces not being painted including surfaces within the paint storage and preparation areas.
4. Exposed Concrete Floors: Floor slabs that will not be covered by other finishes will be protected against staining or damage by the work of the Painting Contractor. Repair of such damage may include replacement of the slab if so determined by the Architect or Owner.

PART 2 PRODUCTS

2.1 Materials

A. Select primary products of the coating system from products of a single manufacturer.

B. Secondary products not specified by name and required for the job such as oils, thinners, patching, compounds, putty, shall be "best grade" or "first line" products of a reputable manufacturer.

C. Compatibility
1. All paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; all tools and equipment shall be compatible with the coating to be applied.
2. Thinners, when used, shall be only those thinners recommended for that purpose by the Manufacturer of the material to be thinned.
3. All shop primers are required to be approved by finish coat paint manufacturer.

D. Colors and glosses: All colors shall be as selected by the Owner and will be limited to not more than six paint colors in the total Work.
1. Colors of paints match color chips submitted to the Owner.

2.2 Acceptable Manufacturers

A. Materials selected for coating systems for each type surface shall be the product of a single manufacturer.

2.3 Mixing and Tinting

A. Deliver paints and enamels ready-mixed to job site.

B. Accomplish job mixing and job tinting only when acceptable to the Owner.

C. Fungicidal agent shall be incorporated into the paint by the Manufacturer.

PART 3 EXECUTION

3.1 Surface Conditions

A. Inspection
   1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
   2. Verify that paint finishes may be applied in strict accord with all pertinent codes and regulations and the requirements of these Specifications.
   3. Examine surfaces schedules to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an acceptable condition through preparatory work as included in Article 3.2 Preparation.
   4. If woodwork, metal or any other surface to be finished cannot be put in proper condition for finishing by customary cleaning, filling, sanding, dusting, puttying operation, notify Owner immediately for clarification.
   5. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.
   6. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums or as required by paint materials manufacturer: (submit written documentation by paint manufacturer).
      a. Plaster and Gypsum Wallboard: 12 percent.
      b. Masonry, Concrete and Concrete Unit Masonry: 12 percent.
      c. Interior Located Wood: 15 percent, measured in accord with ASTM D 2016.
   7. Beginning of installation means acceptance of existing surfaces or substrate.

3.2 Preparation

A. General
   1. Protection: Prior to all surface preparation and painting operation, completely mask, remove or otherwise adequately protect all hardware, accessories, machined surfaces, plates, lighting fixtures and similar items in contact with painted surfaces, but not scheduled to receive paint.
   2. Priming:
      a. Spot prime all exposed nails and other metals which are to be painted with emulsion paints using a primer recommended by the Manufacturer of the coating system.

b. Back prime interior trim before installation, with interior trim primer.

3. Cleaning:
   a. Before applying paint or other surface treatment, thoroughly clean all surfaces involved.
   b. Previously Painted Surfaces:
      (1) Remove all blistered, peeling and scaling paint to bare substrate. Remove heavy chalk by scrubbing with seal and water. Sand or etch any glossy areas and dust clean. Clean and spot prime any failed areas. Rinse clean and let. dry. Any existing mildew on the surface must be completely killed and remove before applying paint.
      (2) Efflorescence should be removed from masonry surfaces. Rusted or abraded areas on painted metal should be thoroughly hand or power toll cleaned and spot primed. For optimum performance in more corrosive areas, entire metal surface should be abrasive blast cleaned. In all cases if the old paint shows poor adhesion, it shall all be removed and the entire surface primed.
      (3) Where new work joints existing work, prepare existing surfaces extending to the nearest break in the plane.
      (4) Wash surfaces with detergent and water or other solution as required to remove any accumulated dirt, oil, grease or other foreign matter which would impair bond or bleed through new finishes. After washing, rinse with water and allow to dry thoroughly.
   c. Schedule all cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
   d. Work will be received broom clean only from General Contractor. Note protection and cleaning required by Painting Contractor.

B. Ferrous Metal Surfaces
   1. Thoroughly clean all surfaces until they are completely free from dirt, oil, rust, scale or grease. When heavy coatings of scale are evident, remove by 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. Spot prime paint after repairs.
   2. Allow to dry thoroughly before application of paint.
   3. Shop Primed Steel Surfaces: 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. Prime metal items including shop primed items.

3.3 Paint Application

A. General
   1. Workmanship: Very best, spread materials evenly, glow on smoothly without runs, sags, employ skilled mechanics.
   2. Use materials only as specified by Manufacturer's direction label on container.
   3. Where interior or exterior wood and metal are primed in the mill or ship, use material in every case same as the specified for such surfaces; use as per Manufacturer's directions for first or priming coat.
   4. Finish door tops, bottoms, edges, same as balance of doors after they are fitted.
   5. Cover surfaced to be stained with uniform stain coat; wipe off as required.
   6. Sand smoothly woodwork to be finished with stain. Clean surface before proceeding with first coat application. Use fine sand paper between coats. Finish wood or metal to produce even, smooth finish.

7. Do not apply finishes to surfaces that are not dry.
8. Each coat shall cover preceding coat, so that preceding coat shall not show through. Each coat of paint shall be slightly darker than preceding coat unless otherwise directed. Undercoats shall be tinted similar to finish coats. Color of priming shall be lighter than body coat. Body coat shall be same color but lighter than finish coat.
9. Paint all surfaces, except glass, flat concrete and similar items, not pre-finished and not called out as unfinished.
10. Apply paint enamel stain and varnish with suitable brushes, or rollers, or spraying equipment.
    a. Rate of application shall not exceed that as recommended by paint Manufacturer for the surface involved.
    b. Keep brushes, and rollers, and spraying equipment clean, dry, free from contaminates and suitable for the finish required.
    c. Apply stain by brush.
11. Finish coats shall be smooth, free of brush marks, streaks, laps or pile up of paints, and skipped or missed areas.
    a. Finished metal surfaces shall be free of skips, voids or pinholes in any coat when tested with a low voltage detector. Test required on first application.
12. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.
13. Apply primer on all work before glazing.
14. Refinish whole wall where portion of finish has been damaged or is not acceptable.
15. Finish metal doors and frames to be Manufacturer's standard primed (not finish coated); finish coats by Painting Contractor.
16. No overhead doors or rolling steel doors should be painted. Rolling steel door track and all tube steel door jambs are scheduled to be painted.
17. All ceilings to be painted except acoustical tile ceilings. See schedules.

B. Drying
    1. Allow sufficient drying time between coats.
    2. Modify the period as recommended by the material Manufacturer to suit adverse weather conditions.

C. Environmental Conditions
    1. Comply with the Manufacturer's recommendations as to environmental conditions under which the coating system may be applied. No painting allowed when temperatures are below 50 degrees F., above 120 degrees F. or with 90% or above relative humidity.
    2. Do not apply paint in areas where dust is being generated.

D. Defects: Sand and dust between coats to remove all defects visible to the unaided eye from a distance of five feet.

E. Dry Mil Thickness
    1. General: Apply all coatings to the dry mil thickness indicated in the "Painting Schedule". In general all painted surfaces to have a DFT as listed unless noted otherwise.

F. Recoating
    1. Whenever possible, notify Architect between coats.

3.4 Reinstallation of Removed Items: Following completion of painting, in each space, promptly reinstall all items removed for painting or wall covering using only workmen skilled in the particular trade.

3.5 Cleaning Up

A. General
1. During profess of the Work, do not allow the accumulation of empty containers or other excess items except in areas specifically set aside for the purpose.
2. Prevent accidental spilling of paint materials and in event of such spill, immediately remove all spilled material and the waste or other equipment used to clean up the

spill, and wash the surfaces to their original undamaged condition, all at no additional cost to the Owner.
3. Collect cotton waste, cloths and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.
4. Touch up and restore finish where damaged.
5. Do not mar surface finish of item being cleaned.
6. Leave storage space clean and in condition required for equivalent spaces in project.

C. Prior to Final Inspection: Upon completion of this portion of the Work visually inspect all surfaces and remove all paint and traces of paint from surfaces not scheduled to be painted.

3.6 Painting Schedule

A. Surfaces Not to be Painted.
1. Pre-finished wall, ceiling and floor coverings.
2. Items with factory applied final finish.
3. Concealed ducts, pipes and conduit.
4. Glass, flat concrete and similar items, not pre-finished.
5. Ceramic tile, acoustical tile and plastic laminate.

B. Exterior Work (use only exterior quality materials) for Pipe Bollards
1. Exterior Ferrous Metals:
   a. Touch-up: PPG Pitt-Tech Plus Primer/Finish 4020;
      Min. DFT: 2.2 – 3.5 mils
      Min. Volume Solids: 44%
   b. 2nd Coat: PPG Break-Through 250 Gloss V70-610
   c. 3rd Coat: PPG Break-Through 250 Gloss V70-610
      Min. DFT: 1.5 mils per coat;
      Min. Volume Solids: 37%;
      Sheen: 70-90 units at 60° degrees.

C. Finishing Mechanical and Electrical Equipment
1. Paint in finished areas only and on exterior of building, exposed or visible galvanized metal ducts, hangers, sheet metal work, conduit boxes, brackets, collars, supports, exposed covered and uncovered plumbing, heating and other piping and conduit. See Mechanical and Electrical Drawings for extent of such work. Do not include painting of pipes, ducts, conduit, etc. in mechanical rooms and other unfinished areas unless specifically noted.

2. Piping or ducts to be hidden above ceilings or in pipe chases will not be painted.

3. Paint plumbing, heating, ventilating and electrical equipment not furnished with factory finish e.g. grilles, louvers, covers and access panels. Equipment furnished with a prime coat shall receive 2 coats of enamel in colors as selected.
4. Paint bright metal portion and interior surfaces of ductwork convectors and baseboard heating cabinets that is visible through grilles and louvers with one coat of flat black paint to the limits of sight lines. Paint dampers exposed behind louvers, grilles and convectors and baseboard cabinets to match face panels.
5. Remove oil or grease from piping and ductwork and apply one coat of primer compatible with surface being finished and with painting material being used for finished coats.
6. In general, exposed covered or uncovered piping and ductwork will be finished with the same materials, number or finish coats of paint and color as the surface to which they are attached.
7. Replace identification markings on mechanical or electrical equipment when painted accidentally.
8. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

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1.1 GENERAL

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

B. Summary: This Section includes the following:
1. Supporting devices for electrical components.
2. Electrical identification.
3. Electricity-metering components.
4. Concrete equipment bases.
5. Electrical demolition.
6. Cutting and patching for electrical construction.
7. Touchup painting.

C. Definitions:
1. EMT: Electrical metallic tubing.
2. FMC: Flexible metal conduit.
3. IMC: Intermediate metal conduit.
4. LFMC: Liquidtight flexible metal conduit.
5. RNC: Rigid nonmetallic conduit.
6. RGSC: Rigid, heavywall, galvanized steel conduct.

D. Submittals:
1. Product Data: For electricity-metering equipment.
2. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.
3. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

E. Quality Assurance:
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.

F. Coordination:
1. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
   a. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

2. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
3. Coordinate electrical service connections to components furnished by utility companies.

a. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
b. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

4. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
5. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
6. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

1.2. PRODUCTS

A. Supporting Devices:
1. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
2. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
3. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.
4. Slotted-Steel Channel Supports: Comply with Division 5 Section "Metal Fabrications" for slotted channel framing.
   a. Channel Thickness: Selected to suit structural loading.
   b. Fittings and Accessories: Products of the same manufacturer as channel supports.
5. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (203 mm) o.c., in at least one surface.
   a. Fittings and Accessories: Products of the same manufacturer as channels and angles.
   b. Fittings and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
6. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
7. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
8. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
9. Expansion Anchors: Carbon-steel wedge or sleeve type.
10. Toggle Bolts: All-steel springhead type.
11. Powder-Driven Threaded Studs: Heat-treated steel.

B. Electrical Identification:
   1. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
   2. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.
      a. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
      b. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.
      c. Color: Black letters on orange background.
      d. Legend: Indicates voltage.

   3. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick (25 mm wide by 0.08 mm thick).
   4. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
      a. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).
      b. Compounded for permanent direct-burial service.
      c. Embedded continuous metallic strip or core.
      d. Printed legend that indicates type of underground line.

   5. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
   6. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
   7. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.
   8. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.
   9. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm), galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6-mm) grommets in corners for mounting.
   10. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

C. Equipment for Utility Company's Electricity Metering:
   1. not used

D. Equipment for Electricity Metering by Owner: Not used.

E. Concrete Bases:

1. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
2. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."

F. Touch-up Paint:
1. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
2. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

1.3. EXECUTION

A. Electrical Equipment Installation:
1. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
2. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
3. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
4. Right of Way: Give to raceways and piping systems installed at a required slope.

B. Electrical Supporting Device Application:
1. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
2. Dry Locations: Steel materials.
3. Support Clamps for PVC Raceways: Click-type clamp system.
4. Selection of Supports: Comply with manufacturer's written instructions.
5. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

C. Support Installation:
1. Install support devices to securely and permanently fasten and support electrical components.
2. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
3. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
4. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
5. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
6. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.
7. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

8. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
9. Simultaneously install vertical conductor supports with conductors.
10. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.
11. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
12. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
13. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
    a. Wood: Fasten with wood screws or screw-type nails.
    b. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
    c. New Concrete: Concrete inserts with machine screws and bolts.
    d. Existing Concrete: Expansion bolts.
    e. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
    f. Steel: Welded threaded studs or spring-tension clamps on steel.
        1) Field Welding: Comply with AWS D1.1.

    g. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
    h. Light Steel: Sheet-metal screws.
    i. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

D. Identification Materials and Devices:
1. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
2. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
3. Self-Adhesive Identification Products: Clean surfaces before applying.
4. Identify raceways and cables with color banding as follows:
    a. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
    b. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (8-m) maximum intervals in congested areas.

c. Colors: As follows:
   1) Fire Alarm System: Red
   2) Security System: Blue and yellow.
   3) Telecommunication System: Green and yellow.

5. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
6. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches (150 to 200 mm) below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm), overall, use a single line marker.
7. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
   a. Phase A: Black
   b. Phase B: Red
   c. Phase C: Blue
   d. Neutral: White
   e. Ground: Green

8. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
   a. Phase A: Yellow
   b. Phase B: Brown
   c. Phase C: Orange
   d. Neutral: Grey
   e. Ground: Green with white trace.

9. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
10. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

E. Utility Company Electricity-Metering Equipment: refer to drawings

F. Firestopping: Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."

G. Concrete Bases: Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

H. Cutting and Patching:
1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
2. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

I. Field Quality Control: Inspect installed components for damage and faulty work, including the following:
1. Raceways
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Electricity-metering components.
6. Concrete bases.
7. Electrical demolition.
8. Cutting and patching for electrical construction.
9. Touchup painting.

J. Refinishing and Touchup Painting: Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

K. Cleaning and Protection:
1. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
2. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

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26 05 03 EQUIPMENT WIRING CONNECTIONS

PART 1 GENERAL

A. SUMMARY

1. Section includes electrical connections to equipment.

2. Related Sections:

    a. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

B. REFERENCES

1. National Electrical Manufacturers Association:
    1. NEMA WD 1 - General Requirements for Wiring Devices.
    2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

C. SUBMITTALS

1. Section 01 33 00 - Submittal Procedures: Submittal procedures.

2. Product Data: Submit wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

3. Manufacturer's installation instructions.

D. CLOSEOUT SUBMITTALS

1. Section 01 70 00 - Execution and Closeout Requirements: Submittal procedures.

2. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

E. COORDINATION

1. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

2. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

3. Determine connection locations and requirements.

4. Sequence rough-in of electrical connections to coordinate with installation of equipment.

5. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

A. CORD AND PLUGS

1. Attachment Plug Construction: Conform to NEMA WD 1.
2. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.
3. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
4. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 EXECUTION

A. EXAMINATION

1. Verify equipment is ready for electrical connection, for wiring, and to be energized.

B. INSTALLATION

1. Make electrical connections.
2. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
3. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
4. Install receptacle outlet to accommodate connection with attachment plug.
5. Install cord and cap for field-supplied attachment plug.
6. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
7. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
8. Install terminal block jumpers to complete equipment wiring requirements.
9. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

C. ADJUSTING

1. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup

operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

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END OF SECTION

26 05 19 LOW VOLTAGE ELECTRCIAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

A. SUMMARY

a. Section includes building wire and cable; nonmetallic-sheathed cable; direct burial cable; service entrance cable; armored cable; metal clad cable; and wiring connectors and connections.

B. REFERENCES

1. International Electrical Testing Association:
   a. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

2. National Fire Protection Association:
   a. NFPA 70 - National Electrical Code.
   b. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

3. Underwriters Laboratories, Inc.:
   a. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

C. SYSTEM DESCRIPTION

1. Product Requirements: Provide products as follows:
   a. Solid conductor for feeders and branch circuits 10 AWG and smaller.
   b. Stranded conductors for control circuits.
   c. Conductor not smaller than 12 AWG for power and lighting circuits.
   d. Conductor not smaller than 14 AWG for control circuits.
   e. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.

2. Wiring Methods: Provide the following wiring methods:
   a. Concealed Dry Interior Locations: Use only building wire in raceway.
   b. Exposed Dry Interior Locations: Use only building wire in raceway.
   c. Above Accessible Ceilings: Use only building wire in raceway.
   d. Wet or Damp Interior Locations: Use only building wire in raceway.
   e. Exterior Locations: Use only building wire in raceway.

D. DESIGN REQUIREMENTS

1. Conductor sizes are based on copper unless indicated as aluminum or "AL".

2. When aluminum conductor is substituted for copper conductor, size to match circuit requirements, terminations, conductor ampacity and voltage drop.

E. SUBMITTALS

1. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

2. Product Data: Submit for building wire and each cable assembly type.

3. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.

4. Test Reports: Indicate procedures and values obtained.

F. CLOSEOUT SUBMITTALS

1. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

2. Project Record Documents: Record actual locations of components and circuits.

G. QUALITY ASSURANCE

1. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

2. Perform Work in accordance with

3. Maintain one copy of each document on site.

H. QUALIFICATIONS

1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

I. FIELD MEASUREMENTS

1. Verify field measurements are as indicated on Drawings.

J. COORDINATION

1. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

2. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

3. Wire and cable routing indicated is approximate unless dimensioned.

PART 2 PRODUCTS

A. BUILDING WIRE

1. Manufacturers:
   a. AETNA
   b. American Insulated Wire Corp.
   c. Colonial Wire
   d. Encore Wire
   e. General Cable Co.
   f. Republic Wire
   g. Rome Cable
   h. Service Wire Co.
   i. Southwire Model
   j. Superior Essex

2. Product Description: Single conductor insulated wire.

3. Conductor: Copper.

4. Insulation Voltage Rating: 600 volts.

5. Insulation Temperature Rating: 75 degrees C.

6. Insulation Material: Thermoplastic.

B. SERVICE ENTRANCE CABLE

1. Manufacturers:
   a. Diamond Wire & Cable Co.
   b. Essex Group Inc.
   c. General Cable Co.

2. Conductor: Copper.

3. Insulation Voltage Rating: 600 volts.

4. Insulation: Type.

C. TERMINATIONS

1. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.

2. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

PART 3 EXECUTION

A. EXAMINATION

1. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

2. Verify interior of building has been protected from weather.

3. Verify mechanical work likely to damage wire and cable has been completed.

4. Verify raceway installation is complete and supported.

B. PREPARATION

1. Completely and thoroughly swab raceway before installing wire.

C. EXISTING WORK

1. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.

2. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.

3. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.

4. Extend existing circuits using materials and methods as specified.

5. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

D. INSTALLATION

1. Route wire and cable to meet Project conditions.

2. Neatly train and lace wiring inside boxes, equipment, and panelboards.

3. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

4. Special Techniques--Building Wire in Raceway:
   a. Pull conductors into raceway at same time.
   b. Install building wire 4 AWG and larger with pulling equipment.

5. Special Techniques - Cable:
   a. Protect exposed cable from damage.

b. Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
c. Use suitable cable fittings and connectors.

6. Special Techniques - Wiring Connections:
   a. Clean conductor surfaces before installing lugs and connectors.
   b. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
   c. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
   d. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
   e. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
   f. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
   g. Install suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.

7. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

8. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.

9. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.

10. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

E. WIRE COLOR

1. General:
   a. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
      1.) Black and red for single phase circuits at 120/240 volts.
      2.) Black, red, and blue for circuits at 120/208 volts single or three phase.
      3.) Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
   b. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
      1.) Black and red for single phase circuits at 120/240 volts.
      2.) Black, red, and blue for circuits at 120/208 volts single or three phase.

3.) Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

2. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

3. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

4. Feeder Circuit Conductors: Uniquely color code each phase.

5. Ground Conductors:
   a. For 6 AWG and smaller: Green.
   b. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

F. FIELD QUALITY CONTROL

1. Section: Field inspecting, testing, adjusting, and balancing.

2. Inspect and test in accordance with NETA ATS, except Section 4.

3. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION

26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Fire stopping relating to electrical work.
7. fire stopping accessories.
8. Equipment bases and supports.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 27 05 29 - Hangers and Supports for Communications Systems.
3. Section 28 05 29 - Hangers and Supports for Electronic Safety and Security.

1.2 REFERENCES

A. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:
1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

E. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.3 DEFINITIONS

A. Fire stopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Fire stopping Materials: ASTM E119, ASTM E814, to achieve fire ratings

B. Surface Burning: ASTM E84 with maximum flame spread / smoke developed rating of 25/450.

C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Fire stopping: Conform to applicable code FM for fire resistance ratings and surface burning characteristics.

B. Fire stopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
   2. Fire stopping: Submit data on product characteristics, performance and limitation criteria.

D. Fire stopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

F. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
   2. Fire stopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Fire stopping of Fire Rated Assemblies: ASTM E814 with 0.10-inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
   2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
      a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Fire stopping of Non-Fire Rated Floor Assemblies: Materials to resist free passage of flame and products of combustion.
   1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
   2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. Perform Work in accordance with

G. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

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

B. Installer: Company specializing in performing work of this section with minimum years' experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply fire stopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of fire stopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. Electroline Manufacturing Company
3. O-Z Gedney Co. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

D. Conduit clamps - general purpose: One-hole malleable iron for surface mounted conduits.

E. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Midland Ross Corporation, Electrical Products Division
4. Unistrut Corp.

B. Product Description: Galvanized 12 gage) thick steel. With holes 1-1/2 inches on center.

2.3 SPRING STEEL CLIPS

A. Product Description: Mounting hole and screw closure.

2.4 SLEEVES

A. Furnish materials in accordance with

B. Sleeves for Through Non-Fire Rated Floors: 18 gage thick galvanized steel.

C. Sleeves for Through Non-Fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

D. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

E. Stuffing Insulation: Glass fiber type, non-combustible.

2.5 MECHANICAL SLEEVE SEALS

A. Manufacturers:
   1. Thunderline Link-Seal, Inc.
   2. NMP Corporation

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

A. Manufacturers:
   1. Dow Corning Corp.
   2. Fire Trak Corp.
   3. Hilti Corp.
   4. International Protective Coating Corp.
   5. 3M fire Protection Products
   6. Specified Technology, Inc.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
   1. Silicone fire stopping Elastomeric fire stopping: Single component silicone elastomeric compound and compatible silicone sealant.
   2. Foam Fire stopping Compounds: Single component foam compound.
   3. Formulated Fire stopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
   4. Fiber Stuffing and Sealant Fire stopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.

5. Mechanical fire stopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent fire stopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: Dark gray.

2.7 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by fire stopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:
1. Mineral fiberboard.
2. Mineral fiber matting.
3. Sheet metal.
4. Plywood or particle board.
5. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive fire stopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of fire stopping material.

B. Remove incompatible materials affecting bond.

C. Obtain permission from Architect/Engineer before using powder-actuated anchors.

D. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:
   1. Concrete Structural Elements: Provide precast inserts, powder actuated anchors and preset inserts.
   2. Steel Structural Elements: Provide beam clamps.
   3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
   4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide hollow wall fasteners.
   5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
   6. Sheet Metal: Provide sheet metal screws.
   7. Wood Elements: Provide wood screws.

B. Inserts:
   1. Install inserts for placement in concrete forms.
   2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

C. Install conduit and raceway support and spacing in accordance with NEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:
   1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
   2. Install surface mounted cabinets and panelboards with minimum of four anchors.
   3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.

4. Support vertical conduit at every other floor.

G. Install Work in accordance with

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring fire stopping.

B. Apply primer where recommended by manufacturer for type of fire stopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply fire stopping material in sufficient thickness to achieve required fire and smoke rating.

D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

E. Place intumescent coating in sufficient coats to achieve rating required.

F. Remove dam material after fire stopping material has cured.

G. Fire Rated Surface:
1. Seal opening at floor, ceiling, as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
   c. Pack void with backing material.
   d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
2. Where cable tray, bus, cable bus, conduit, wireway, trough, penetrates fire rated surface, install fire stopping product in accordance with manufacturer's instructions.

H. Non-Rated Surfaces:
1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
   c. Install type of fire stopping material recommended by manufacturer.
2. Install escutcheons floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations at telecommunication rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with stuffing insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install chrome plated steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

A. Section: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed fire stopping for compliance with specifications and submitted schedule.

3.8 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of fire stopping materials.

3.9 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

1.1 GENERAL

A. Summary: Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

B. References:
1. American National Standards Institute:
   a. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
   b. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
   c. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

2. National Electrical Manufacturers Association:
   a. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   c. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   d. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
   e. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   f. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   g. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

C. System Description:
1. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
2. Underground More than 5 feet outside Foundation Wall: Provide rigid steel conduit or non-metallic conduit. Provide cast metal boxes or nonmetallic handhole.
3. Underground Within 5 feet from Foundation Wall: Provide rigid steel conduit, or nonmetallic conduit. Provide cast metal or nonmetallic boxes.
4. In or Under Slab on Grade: Provide rigid steel conduit, thickwall nonmetallic conduit. Provide cast or nonmetallic metal boxes. Conduit penetrating a floor slab shall be rigid steel only (transition to rigid below slab).
5. Outdoor Locations, Above Grade: Provide, intermediate metal conduit or rigid steel conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.
6. In Slab Above Grade: Provide, intermediate metal conduit, or electrical metallic tubing. Provide cast boxes.

7. Wet and Damp Locations: Provide rigid steel conduit, or thickwall nonmetallic conduit. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.
8. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
9. Exposed Dry Locations: Provide, electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
10. Indoor or Outdoor High Corrosion Locations (such as salt storage or processing areas). Provide PVC sch40 conduit and PVC boxes.

D. Design Requirements:
   1. Minimum Raceway Size: 3/4 inch unless otherwise specified.

E. Submittals:
   1. Section 01 33 00 - Submittal Procedures: Submittal procedures.
   2. Product Data: Submit for the following:
      a. Flexible metal conduit.
      b. Liquidtight flexible metal conduit.
      c. Nonmetallic conduit.
      d. Flexible nonmetallic conduit.
      e. Nonmetallic tubing.
      f. Raceway fittings.
      g. Conduit bodies.
      h. Surface raceway.
      i. Wireway
      j. Pull and junction boxes.
      k. Handholes

   3. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

F. Closeout Submittals:
   1. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
   2. Project Record Documents:
      a. Record actual routing of conduits larger than 2 inch.
      b. Record actual locations and mounting heights of outlet, pull, and junction boxes.

G. Delivery, Storage, and Handling:
   1. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
   2. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
   3. Protect PVC conduit from sunlight.

H. Coordination:
1. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
2. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

1.2. PRODUCTS

A. Metal Conduit:
1. Manufacturers:
a. Carlon Electrical Products
b. Hubbell Wiring Devices
c. Thomas & Betts Corp.
d. Walker Systems Inc.
e. The Wiremold Co.

2. Rigid Steel Conduit: ANSI C80.1.
3. Rigid Aluminum Conduit: ANSI C80.5.
4. Intermediate Metal Conduit (IMC): Rigid steel.
5. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

B. Flexible Metal Conduit
1. Manufacturers:
a. Carlon Electrical Products
b. Hubbell Wiring Devices
c. Thomas & Betts Corp.
d. Walker Systems Inc.
e. The Wiremold Co.
f. Substitutions

2. Product Description: Interlocked steel construction.
3. Fittings: NEMA FB 1.

C. Liquidtight Flexible Metal Conduit:
1. Manufacturers:
a. Carlon Electrical Products
b. Hubbell Wiring Devices
c. Thomas & Betts Corp.
d. Walker Systems Inc.
e. The Wiremold Co. Product Description: Interlocked steel construction with PVC jacket.

2. Fittings: NEMA FB 1.

D. Electrical Metallic Tubing (EMT):
1. Manufacturers:
a. Carlon Electrical Products
b. Hubbell Wiring Devices
c. Thomas & Betts Corp.
d. Walker Systems Inc.

e. The Wiremold Co.

2. Product Description: ANSI C80.3; galvanized tubing.
3. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron, compression type.

E. Nonmetallic Conduit:
1. Manufacturers:
   a. Carlon Electrical Products
   b. Hubbell Wiring Devices
   c. Thomas & Betts Corp.
   d. Walker Systems Inc.
   e. The Wiremold Co.

2. Product Description: NEMA TC 2; Schedule 40 PVC.
3. Fittings and Conduit Bodies: NEMA TC 3.

F. Surface Metal Raceway:
1. Manufacturers:
   a. Carlon Electrical Products
   b. Hubbell Wiring Devices
   c. Thomas & Betts Corp.
   d. Walker Systems Inc.
   e. The Wiremold Co.

2. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
3. Finish: Gray enamel.
4. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.

G. Surface Nonmetal Raceway:
1. Manufacturers:
   a. Carlon Electrical Products
   b. Hubbell Wiring Devices
   c. Thomas & Betts Corp.
   d. Walker Systems Inc.
   e. The Wiremold Co. M

2. Product Description: Plastic channel with fitted cover, suitable for use as surface raceway.
3. Finish: Gray.
4. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories, finish to match raceway.

H. Wireway:
1. Manufacturers:
   a. Carlon Electrical Products
   b. Hubbell Wiring Devices
   c. Thomas & Betts Corp.
   d. Walker Systems Inc.

e. The Wiremold Co.

2. Product Description: General purpose type wireway.
3. Knockouts: Manufacturer's standard.
4. Size: 6 x 6 inch 8 x 8 inch; length as indicated on Drawings.
5. Cover: Screw cover
6. Connector: Slip-in.
7. Fittings: Lay-in type with removable top, bottom, and side; captive screws.
8. Finish: Rust inhibiting primer coating with gray enamel finish.

I. Outlet Boxes:
1. Manufacturers:
a. Carlon Electrical Products
b. Hubbell Wiring Devices
c. Thomas & Betts Corp.
d. Walker Systems Inc.
e. The Wiremold Co.

2. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
a. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
b. Concrete Ceiling Boxes: Concrete type.

3. Nonmetallic Outlet Boxes: NEMA OS 2.
4. Cast Boxes: NEMA FB 1, Type FD. Furnish gasketed cover by box manufacturer.
5. Wall Plates for Unfinished Areas: Furnish gasketed cover.

J. Pull and Junction Boxes:
1. Manufacturers:
a. Carlon Electrical Products
b. Hubbell Wiring Devices
c. Thomas & Betts Corp.
d. Walker Systems Inc.
e. The Wiremold Co. Model

2. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
3. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

K. Adjusting:
1. Section 01 70 00 - Execution and Closeout Requirements:Testing, adjusting, and balancing.
2. Adjust flush-mounting outlets to make front flush with finished wall material.
3. Install knockout closures in unused openings in boxes.

L. Cleaning:
1. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

2. Clean interior of boxes to remove dust, debris, and other material.
3. Clean exposed surfaces and restore finish.

END OF SECTION

26 05 53 IDENTIFICATIONS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Nameplates.
2. Labels.
3. Wire markers.
4. Conduit markers.
5. Stencils.
6. Underground Warning Tape.
7. Lockout Devices.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Submit manufacturer’s catalog literature for each product required.
2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

C. Samples:
1. Submit two tags, actual size.
2. Submit two labels, actual size.
3. Submit samples of each type of identification products applicable to project.
4. Submit nameplates, 4 x 4 inch (mm) in size illustrating materials and engraving quality.

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

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section three years’ experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Install labels only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.

B. Letter Size:
1. 1/8 inch (3 mm) high letters for identifying individual equipment and loads.
2. 1/4 inch (6 mm) high letters for identifying grouped equipment and loads.

C. Minimum nameplate thickness: 1/8 inch (3 mm).

2.2 LABELS

A. Labels: Embossed adhesive tape, with 3/16 inch (5 mm) white letters on black background.

2.3 WIRE MARKERS

A. Description: Cloth tape, split sleeve, or tubing type wire markers.

B. Legend:
1. Power and Lighting Circuits: Branch circuit or feeder number.
2. :

2.4 CONDUIT AND RACEWAY MARKERS

A. Description: Nameplate fastened with adhesive Labels fastened with adhesive.

B. Color:
1. Medium Voltage System:
2. 480 Volt System: Black lettering on white background.
3. 208 Volt System: Black lettering on white background.

C. Legend:
1. Medium Voltage System: HIGH VOLTAGE.
2. 480 Volt System: 480 VOLTS.
3. 208 Volt System: 208 VOLTS.
4. System:

2.5 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
1. Up to 2 inches (50 mm) Outside Diameter of Raceway: 1/2 inch (13 mm) high letters.
2. 2-1/2 to 6 inches (64 to 150 mm) Outside Diameter of Raceway: 1 inch (25 mm) high letters.

B. Stencil Paint: As specified in Section, semi-gloss enamel, colors conforming to the following:
1. Black lettering on white background.

2.6 UNDERGROUND WARNING TAPE

A. Description: 4 inch (100 mm) wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.1 PREPARATION

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

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.2 EXISTING WORK

A. Install identification on existing equipment to remain in accordance with this section.

B. Install identification on unmarked existing equipment.

C. Replace lost nameplates markers.

D. Re-stencil existing equipment.

3.3 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:
   1. Install nameplate parallel to equipment lines.
   2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
   3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
   4. Secure nameplate to equipment front using screws, rivets, or adhesive.
   5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
   6. Install nameplates for the following:
      a. Switchboards.
      b. Panelboards.
      c. Transformers.
      d. Service Disconnects.
      e. .

C. Label Installation:
   1. Install label parallel to equipment lines.
   2. Install label for identification of individual control device stations, and.
   3. Install labels for permanent adhesion and seal with clear lacquer.

D. Wire Marker Installation:
   1. Install wire marker for each conductor at each load connection.
   2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
   3. Install labels at data outlets identifying patch panel and port designation as indicated on Drawings.

E. Conduit Raceway Marker Installation:
   1. Install conduit raceway marker for each conduit raceway longer than 6 feet (2000 mm).
   2. Conduit Raceway Marker Spacing: 20 feet (6000 mm) on center.

F. Underground Warning Tape Installation:
   1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION

26 24 13 Quick Connect Input/Output Power Panels

1. GENERAL

1.1. Quick Connect Input Power panels shall provide a convenient, reliable and economical way to connect temporary emergency power from portable generators to a facility in conjunction with an ASCO transfer switch. Quick Connect Output Panels shall provide a convenient way to connect load banks to a facility.

1.2. The Quick Connect Power panels shall be available in rating configurations from 400 Amp to 4000 Amp Service. Input Panels shall be listed to UL 1008 as a transfer switch accessory; Output Panels shall be listed to UL 891 for Switchboards.

1.3. Quick Connect Power Panels shall be ASCO 300 Series (3QC). Any alternate shall be submitted for approval to the consulting engineer at least 10 days prior to bid. Alternate bids must list any deviations from this specification.

2. MECHANICAL

2.1. All quick connect power panels shall be Type 3R compliant and constructed of aluminum, mild steel or Stainless Steel. The Type 3R rating shall be maintained with the temporary cables installed.

2.2. Cables shall enter and exit the wiring chamber via access holes specifically designed for conductors and shall be provided with a bushing or shall be formed so that there are no sharp edges with which conductor insulation may come in contact.

2.3. Connections shall be arranged so that cables drape downward when connected.

2.4. 400-800 Amp Models

2.4.1. The quick connect panel shall have an enclosure manufactured of aluminum and painted ANSI 61 gray or Grade 316 stainless steel.

2.4.2. The quick connect panel enclosure dimensions shall be 24" wide x 32” high x 11” deep.

2.4.3. The quick connect panel shall include four (4) integral mounting tabs for wall mounting.

2.4.4. The quick connect panel shall be divided into an upper termination chamber and a lower wiring chamber.

2.4.5. The upper termination chamber shall have a dead front panel covering all exposed electrical parts.

2.4.6. The lower chamber shall have individual cable holes to restrict access and reducing the possibility of theft.

2.4.7. The cable access holes shall have a hinged cover held closed by springs inherently resistant to corrosion in order to securely cover the cable access holes when the temporary cables are not installed.

2.4.8. The quick connect panel shall have an additional cable lock plate to reduce risk of cable theft. This lock plate will also serve to lock the hinged cable access door(s) when the temporary power cables are not installed.

2.4.9. The quick connect panel shall have an outer single hinged access door restricting access to both wiring chambers for safety and security.

2.4.10. The outer access door shall have a padlock hasp preventing unauthorized entry.

2.5. 1200 and 1600 Amp Models

2.5.1. The quick connect panel shall have an enclosure manufactured of 12 gauge galvanized steel painted ANSI 61 gray or 316 stainless steel..

2.5.2. The quick connect panel enclosure dimensions shall be 35” wide x 56” high x 28” deep.

2.5.3. The quick connect panel shall include four (4) feet for floor or concrete pad mounting. Holes in the bottom of the feet shall be available for anchoring the enclosure to the floor or pad.

2.5.4. The quick connect panel shall be divided into an upper termination chamber and a lower wiring chamber.

2.5.5. The upper termination chamber shall have a key lock handle door covering all exposed electrical parts.

2.5.6. The lower chamber main door shall have a key lock handle main door covering all exposed camlock connectors.

2.5.6.1. The lower chamber main door shall have a smaller trap door for cable egress. This trap door shall have a key lock handle to preventing unauthorized entry.

2.6. 2000A-4000A Amp Models

2.6.1. The quick connect power panel shall have an enclosure manufactured of aluminum or 316 stainless steel.

2.6.2. The quick connect panel shall not have enclosure dimensions that exceed 39.00" H x 31.00” W x 50.00”D for 2000A and 39.00" H x 48.00” W x 50.00”D for 2400A and above.

2.6.3. The quick connect panel shall be able to accommodate rear, side and bottom cable entry.

2.6.4. Multiple Chamber style design to isolate permanent connections and camlock connections.

2.6.5. Pad-lockable tamper resistant door preventing access to temporary connections while unit is in use.

2.6.6. Trap door for cable egress.

2.6.6.1. 45 degree camlocks for hassle free connection eliminating stress on cables during operation.

2.6.7. Provisions for Trap Key interlock prevent access to temporary connections while cables are energized.

2.6.8. Slotted fingers to restrict cable access reducing theft.

3. **ELECTRICAL**

3.1. The quick connect panel shall be have input and output connections rated up to 600 VAC, as specified in the contract documents.

3.1.1. Input Panels - Recessed male connectors

3.1.2. Output Panels - Female connectors with flip covers.

3.2. All electrical connectors shall be cam type single pole connectors compatible with Marinco or Leviton 16 Series CAM Locks™ and available color coded as per industry standard practice:

3.2.1. 240V and below: phase 1 = black, phase 2 = red, phase 3 = blue (if required).

3.2.2. 440 to 480V: phase 1 = brown, phase 2 = orange, phase 3 = yellow.

3.2.3. Ground shall always be green.

3.2.4. Neutral shall always be white.

3.3. 400-800 Amp Models

3.3.1. The upper termination chamber shall be provided with lug terminals for the permanently installed conductors.

3.3.2. The lower chamber shall have the cam type single pole connectors as specified above:

3.3.2.1. For 400A models, there shall be one (1) row of up to five (5) series single pole connections.

3.3.2.2. For 800A models, there shall be two (2) rows of up to five (5) single pole connections.

3.3.3. Withstand Current Rating (WCR) shall be no less than 10kA verified by testing supervised by a Nationally Recognized Testing Laboratory, not by calculation.

3.4. 1200-1600A Amp Models

3.4.1. The upper termination chamber shall have copper buss bars:

3.4.1.1. Designed for a current density not to exceed 725 amps per square inch cross sectional area

3.4.1.2. With holes to accommodate standard ½" hardware drilled on 1.95" centers.

3.4.2. The lower chamber shall have the cam type single pole connectors as specified above:

3.4.2.1. For 1200A, there shall be three (3) rows of up to 5 single pole connections.

3.4.2.2. For 1600A, there shall be four (4) rows of up to 5 single pole connections.

3.4.3. Withstand Current Rating (WCR) shall be no less than 22kA verified by testing supervised by a Nationally Recognized Testing Laboratory, not by calculation.

3.5. 2000A-4000A Amp Models

3.5.1. The rear chamber which houses the permanent connections will have mechanical lugs.

3.5.1.1. For 2000A, there shall be six (6) single (#2 AWG to 600 MCM) mechanical lugs.

3.5.1.2. For 2400A, there shall be eight (8) single (#2 AWG to 600 MCM) mechanical lugs.

3.5.1.3. For 2800A, there shall be nine (9) single (#2 AWG to 600 MCM) mechanical lugs.

3.5.1.4. For 3200A, there shall be ten (10) single (#2 AWG to 600 MCM) mechanical lugs.

3.5.1.5. For 3600A, there shall be eleven (11) single (#2 AWG to 600 MCM) mechanical lugs.

3.5.1.6. For 4000A, there shall be twelve (12) single (#2 AWG to 600 MCM) mechanical lugs.

3.5.2. The front of the panel shall have the cam type single pole connectors as specified above:

3.5.2.1. For 2000A, there shall be three (5) rows of up to 5 single pole connections.

3.5.2.2. For 2400A, there shall be four (6) rows of up to 5 single pole connections.

3.5.2.3. For 2800A, there shall be three (7) rows of up to 5 single pole connections.

3.5.2.4. For 3200A, there shall be four (8) rows of up to 5 single pole connections.

3.5.2.5. For 3600A, there shall be three (9) rows of up to 5 single pole connections.

3.5.2.6. For 4000A, there shall be four (10) rows of up to 5 single pole connections.

3.5.3. Withstand Current Rating (WCR) shall be no less than 100kA verified by testing supervised by a Nationally Recognized Testing Laboratory, not by calculation.

3.5.4. Phase Rotation Monitor

3.5.5. Two wire auto start

4. **COMPLIANCE**

4.1. The 400-4000 Amp quick connect Input panel must be listed to UL 1008 under Annex J as a Transfer Switch Accessory. Output Panel must be listed to UL 891 for Panelboards.

4.2. “Built to the standard” shall not be allowed: the quick connect panels shall be tested in accordance with and listed to UL 1008 or UL 891 standards.

4.3. UL 50 Listed enclosures may be used but only listed to UL 50 shall not be acceptable.

5. **Warranty & Service**

5.1. The Quick Connect panel shall come with a warranty of no less than 24 months from date of shipment.

5.2. The Quick Connect Power Panel provider shall maintain a national service organization of company-employed personnel located throughout the contiguous United States.

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26 28 26 AUTOMATIC TRANSFER SWITHCES

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switch.

1.3 SUBMITTALS

A. Product Data: Include ratings and dimensioned plans, sections, and elevations showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

B. Wiring Diagrams: Detail wiring for transfer switches and differentiate between manufacturer-installed and field-installed wiring. Show both power and control wiring.

C. Product Certificates: Signed by manufacturer certifying that products furnished comply with requirements and that switches have been tested for load ratings and short-circuit closing and withstand ratings applicable to units for Project.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

E. Maintenance Data: For each type of product to include in maintenance manuals specified in Division 1. Include all features and operating sequences, both automatic and manual. List all factory settings of relays and provide relay-setting and calibration instructions, including software, where applicable.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing emergency maintenance and repairs at Project site with an eight-hour maximum response time.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for emergency service under UL 1008, by a testing agency acceptable to authorities having jurisdiction.

C. Comply with NEMA ICS 1.

D. Comply with NFPA 70.

E. Comply with NFPA 99.

F. Comply with NFPA 110.

G. Comply with UL 1008, unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Conventional Automatic Transfer Switches:

a. Caterpillar, Inc.; Engine Division.

b. Cummins
c. Emerson Electric Co.; Automatic Switch Co. Subsidiary.

d. Kohler Co.
e. Onan Corp.; Electrical Products Division.
f. Spectrum Detroit Diesel.
g. Zenith Controls, Inc.
h. Asco Power Technologies

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where Transfer Switch Includes Internal Fault-Current Protection: Rating of switch and trip unit combination exceeds indicated fault-current value at installation location.

C. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels have communications capability matched with remote device.

D. Solid-State Controls: Repetitive accuracy of all settings is plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

E. Resistance to Damage by Voltage Transients: Components meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components meet or exceed voltage-impulse withstand test of NEMA ICS 1.

F. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

G. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6; UL 508, unless otherwise indicated.

H. Heater: Equip switches exposed to outdoor temperature and humidity conditions, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.

I. Factory Wiring: Train and bundle factory wiring and label consistent with Shop Drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.

1. Designated Terminals: Pressure type suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

J. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

K. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units rated 225 A and greater have separate arcing contacts.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is the same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

E. Signal-before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

F. Digital Communications Interface: Matched to capability of remote annunciator or annunciator and control panel.

G. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

H. Automatic Open-Transition Transfer Switches: Functions and characteristics:

1. Failure of the power source serving the load initiates automatic open transfer.

2.4 FINISHES

A. Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

2.5 SOURCE QUALITY CONTROL

A. Factory Test Components, Assembled Switches, and Associated Equipment: Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wall-Mounted Switch: Level and anchor unit to wall.

B. Install according to manufacturer’s written direction

C. Identify components according to Division 16 Section "Basic Electrical Materials and Methods."

D. Identify components according to Division 16 Section "Electrical Identification."

3.2 CONNECTIONS

A. Ground equipment as indicated and as required by NFPA 70.

3.3 FIELD QUALITY CONTROL

A. Testing: Test transfer-switch products by operating them in all modes. Perform tests recommended by manufacturer under the supervision of manufacturer's factory-authorized service representative. Correct deficiencies and report results in writing. Record adjustable relay settings.

B. Coordinate tests with tests of generator plant and run them concurrently.

C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.4 CLEANING

A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean equipment internally, on completion of installation, according to manufacturer's written instructions.

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END OF SECTION

26 32 13 PACKAGED ENGINE GENERATORS

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes packaged generator sets with the following features and accessories:

1. Battery charger.
2. Engine generator set.
3. Muffler.
4. Outdoor enclosure.
5. Remote stop switch.
6. Starting battery.

1.3 DEFINITIONS

A. Standby Rating: Power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of a power outage.

B. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

C. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hertz or cycles per second.

1.4 SUBMITTALS

A. Product Data: Include data on features, components, ratings, and performance. Include the following:

1. Dimensioned outline plan and elevation drawings of engine generator set and other components specified.
2. Thermal damage curve for generator.
3. Time-current characteristic curves for generator protective device.

B. Shop Drawings: Indicate fabrication details, dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Wiring Diagrams: Detail wiring for power and control connections and differentiate between factory-installed and field-installed wiring.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

D. Field Test and Observation Reports: Indicate and interpret test results and inspection records relative to compliance with performance requirements.

E. Certified summary of prototype-unit test report.

F. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.

G. Certified Summary of Performance Tests: Demonstrate compliance with specified requirement to meet performance criteria for sensitive loads.

H. Maintenance Data: For each packaged engine generator and accessories to include in maintenance manuals specified in Division 1. Include the following:
   1. Detail operating instructions for both normal and abnormal conditions.

I. Factory Warranty Documents.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of emergency maintenance and repairs at the Project with eight hours' maximum response time.

B. Source Limitations: Obtain packaged engine generator and auxiliary components specified in this Section through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. Comply with NFPA 70.

E. Comply with NFPA 99.

F. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

G. Comply with NFPA 110 requirements for Level 2 emergency supply system.

H. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver engine generator set and system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is safe from such hazards.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1. Warranty Period: Two years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Base bid shall be Cummins.

B. Manufacturers: Alternate bid

1. Caterpillar, Inc.; Engine Div.
2. Kohler Co; Generator Division.
3. MTU Rolls Royce

2.2 ENGINE GENERATOR SET

A. Furnish a coordinated assembly of compatible components.

B. Output Connections: Three phase, four wire.

C. Safety Standard: Comply with ASME B15.1.

D. Nameplates: Each major system component is equipped with a conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of item.

E. Limiting dimensions indicated for system components are not exceeded.

F. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.

G. Skid: Adequate strength and rigidity to maintain alignment of mounted components without depending on a concrete foundation. Skid is free from sharp edges and corners. Lifting attachments are arranged to facilitate lifting with slings without damaging any components.

H. Rigging Diagram: Inscribed on a metal plate permanently attached to skid. Diagram indicates location and lifting capacity of each lifting attachment and location of center of gravity.Select one of two articles below to match overall generator-set performance to basic load characteristics of Project. Edit performance to specific needs.

2.3 SERVICE CONDITIONS

A. Environmental Conditions: Engine generator system withstands the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
   1. Ambient Temperature: Minus 15 to plus 40 deg C.
   2. Relative Humidity: 0 to 95 percent.
   3. Altitude: Sea level to 1000 feet (300 m).

2.4 ENGINE

A. Comply with NFPA 37.

B. Fuel: Diesel

C. Lubrication System: Pressurized by a positive-displacement pump driven from engine crankshaft. The following items are mounted on engine or skid:

   1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
   2. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps or siphons or special tools or appliances.

D. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment. Include any circuit/conduit/control requirements iaw the manufacturers requirements to support this heater.

E. Diesel Engine: Engine shall be 4 cycle, turbocharged/aftercooled or normally aspirated engine, water-cooled with mounted water pump. EPA tier 2 emissions certification.

2.5 GOVERNOR

A. Type: electronic

2.6 ENGINE COOLING SYSTEM

A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine generator-set skid and integral engine-driven coolant pump.

B. Radiator: Rated for specified coolant. Rated for 40c ambient.

C. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

D. Expansion Tank: Constructed of welded steel plate and equipped with gage glass and petcock.

E. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

F. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

1. Rating: 50-psig (345-kPa) maximum working pressure with 180 deg F (82 deg C) coolant, and noncollapsible under vacuum.
2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

2.7 ENGINE EXHAUST SYSTEM

A. Muffler: Residential grade, sized as recommended by engine manufacturer. Measured sound level at a distance of 10 feet (3 m) from exhaust discharge, is 95 dBA or less.

B. Connections from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.

C. Furnish and install pipe connections and terminations thru roof as recommended by the manufacturer.

2.8 COMBUSTION-AIR-INTAKE

A. Description: Standard-duty engine-mounted air cleaner with replaceable dry filter element and "blocked filter" indicator.

2.9 STARTING SYSTEM

A. Description: 12-V or 24V electric, with negative ground and including the following items:

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by generator set manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater is arranged to maintain

battery above 10 deg C regardless of external ambient temperature within range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above. Include accessories required to support and fasten batteries in place.

7. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit complies with UL 1236 and includes the following features:

   a. Operation: Equalizing-charging rate of 10 A is initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to a lower float-charging mode and continues operating in that mode until battery is discharged again.
   b. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
   c. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus or minus 10 percent.
   d. Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.
   e. Safety Functions: Include sensing of abnormally low battery voltage arranged to close contacts providing low battery voltage indication on control and monitoring panel. Also include sensing of high battery voltage and loss of ac input or dc output of battery charger. Either condition closes contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
   f. Include any circuit/conduit/control requirements iaw the manufacturers requirements to support this heater.

2.10 CONTROL AND MONITORING

A. Functional Description: When the mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic-transfer switches initiate starting and stopping of the generator set. When the mode-selector switch is switched to the on position, the generator set manually starts. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set.

B. Functional Description: Switching on-off switch on the generator control panel to the on position starts the generator set. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set.

C. Configuration: Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components are grouped in a combination control and

power panel. Control and monitoring section of panel is isolated from power sections by steel barriers.

D. Indicating and Protective Devices and Controls: Include the following:

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
8. Start-stop switch.
9. Overspeed shutdown device.
10. Coolant high-temperature shutdown device.
11. Coolant low-level shutdown device.
12. Oil low-pressure shutdown device.
13. Generator overload.

E. Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer's standard.

F. Remote Emergency-Stop Switch: Flush wall-mounted, unless otherwise indicated and prominently labeled. Push button is protected from accidental operation.

2.11 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. type; 100 percent rated; complying with NEMA AB 1 and UL 489.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator rating.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

B. Generator Protector: Microprocessor-based unit that continuously monitors current level in each phase of generator output, integrates generator heating effect over time, and predicts when thermal damage of the alternator will occur. When signaled by the protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from the load circuits. Protector performs the following functions:

1. Initiates a generator overload alarm when the generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
2. Under single or three-phase fault conditions, regulates the generator to 300 percent of rated full-load current for up to 10 seconds.

3. As heating effect on the generator of overcurrent approaches the thermal damage point of the unit, the protector switches the excitation system off, opens the generator disconnect switch, and shuts down the generator set.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

C. Ground-Fault Indication: Comply with NFPA 70, Article 700-7(d). Integrate ground-fault alarm indication with other generator-set alarm indications.

2.12 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1 and specified performance requirements.

B. Drive: Generator shaft is directly connected to engine shaft. Exciter is rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction prevents mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Excitation uses no slip or collector rings, or brushes, and is arranged to sustain generator output under short-circuit conditions as specified.

G. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel provides plus or minus 5 percent adjustment of output- voltage operating band.

2.13 FINISHES

A. Indoor Components: Manufacturer's standard enamel over corrosion-resistant pretreatment and compatible standard primer.

2.14 OUTDOOR ENCLOSURE.

1. Manufacturer furnished sound attenuating type. The generator set shall be provided with an outdoor enclosure, with the entire package listed under UL 2200. The package shall comply with the requirements of NEC for wiring materials and component spacing. The total assembly of generator set, enclosure, and sub-base fuel tank (when used) shall be designed to be lifted into place using spreader bars. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 100 °F (38 °C). The housing shall have hinged access doors as required to maintain easy access for operating and service functions. Doors shall be lockable. Enclosure roof shall be cambered to prevent rainwater accumulation.

Openings shall be screened to limit access of rodents into the enclosure. Electrical power and control interconnections shall be made within the perimeter of the enclosure.

2. Sheet metal shall be primed for corrosion protection and finish-painted with the manufacturers standard color using a two-step electro-coating paint process, or equal, meeting the performance requirements specified below. Surfaces of metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:
   a. Primer thickness shall be 0.5 mil (0.13 mm) to 2.0 mils (0.51 mm). Top coat thickness shall be 0.8 mil (0.20 mm) to 1.2 mils (0.30 mm).
   b. Gloss, per ASTM D 523 shall be 80 percent, ±5 percent. Gloss retention after one year shall exceed 50 percent.
   c. Crosshatch adhesion, per ASTM D 3359, shall be 4B to 5B.
   d. Impact resistance, per ASTM D 2794, shall be 160 inch pounds (13.56 N·m) to 160 inch pounds (18.08 N·m).
   e. Salt spray, per ASTM B 117, shall be 1000+ hours.
   f. Humidity, per ASTM D 2247, shall be 1000+ hours.
   g. Water soak, per ASTM D 2247, 1000+ hours.
3. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion-resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.
4. Enclosure shall be constructed of minimum 12 gage steel for framework and 14 gage steel for panels. Hardware and hinges shall be stainless steel.
5. A factory-mounted exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.
6. The enclosure shall include, but shall not be limited to, the following maintenance provisions:
   a. Flexible coolant and lubricating oil drain lines, that shall extend to the exterior of the enclosure, with internal drain valves.
7. Provide external radiator fill provision.
8. The generator set shall be provided with a sound-attenuated housing which shall allow the generator set to operate at full rated load in an ambient temperature of up to 100 °F (38 °C). The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 72 dBA at any location 23 feet (7 m) from the generator set in a free field environment.
9. The enclosure shall be insulated with non-hygroscopic materials.

2.15 Base Mount Day Tank.

B. A dual-wall sub-base fuel storage tank sized for 24 hours full load operation. The tank shall be constructed of corrosion-resistant steel and shall be UL-listed. The equipment, as installed, shall meet local and regional requirements for above ground tanks.

C. Provide a sub-base fuel tank for the generator set, sized to allow for full load operation of the generator set for 24 hours. The sub-base fuel tank shall be UL 142-listed and labeled.

Installation shall be in compliance to NFPA 37. The fuel tank shall be a double-walled, steel construction and shall include, but shall not be limited to, the following features:

1. Emergency tank and basin vents.
2. Mechanical level gauge.
3. Fuel supply and return lines, connected to generator set with flexible fuel lines as recommended by the engine manufacturer and in compliance to UL 2200 and NFPA 37 requirements.
4. Leak detection provisions, wired to the generator set control for local and remote alarm indication.
5. Continuous float level gauge. Wire gauge to generator control to be remote indication of fuel level and runtime when used with compatible ATS.
6. Basin drain.
7. Integral lifting provisions
8. Overfill catch basin with drain.

PART 3 - EXECUTION

3.1 EXAMINATION

A. EC shall secure any necessary special permits for this work, including fuel tank.

B. Examine areas, equipment foundations, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Examine roughing-in electrical connections. Verify actual locations of connections before packaged engine generator installation.

3.2 INSTALLATION

A. Comply with packaged engine generator manufacturers' written installation and alignment instructions, and with NFPA 110.

B. Set packaged engine generator set on slab / floor with vibration isolators.

C. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

D. Furnish and install exterior grade, sound attenuating housing. Refer to drawing schedules.

E. Install accessories, hangers and supports, and anchors for complete installation.

F. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

1. Verify that electrical wiring is installed according to manufacturers' submittal. Proceed with equipment startup only after wiring installation is satisfactory.

3.3 CONNECTIONS

A. Electrical wiring and connections as shown by drawings and as directed by manufacturer.

B. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to assist in testing. Report results in writing.

B. Testing: Perform field quality-control testing under the supervision of the manufacturer's factory-authorized service representative.

C. Tests: Include the following:

1. Tests recommended by manufacturer.
2. InterNational Electrical Testing Association Tests: Perform each visual and mechanical inspection and electrical and mechanical test stated in NETA ATS for emergency engine generator sets, except omit vibration baseline test. Certify compliance with test parameters for tests performed.

3. Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery. Verify acceptance of charge for each element of battery after discharge. Verify measurements are within manufacturer's specifications.
4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust Emissions Test: Comply with applicable government test criteria.

D. Coordinate tests with tests for transfer switches and run them concurrently.

E. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

F. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

G. Test instruments shall have been calibrated within the last 12 months, traceable to standards of the National Institute for Standards and Technology, and adequate for making positive observation of test results. Make calibration records available for examination on request.

3.5 CLEANING

A. On completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators as specified below:

1. Coordinate this training with that for transfer switches.
2. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
3. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
4. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
5. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

26 36 13 MANUAL TRANSFER SWITCHES

PART 1 GENERAL

1.01 Scope

Furnish and install manual transfer switches (3MTS) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Each manual transfer shall consist of a 3 position center off mechanically held power transfer switch unit and a mechanical operating mechanism to provide complete manual operation. All transfer switches and mechanical operating mechanism shall be the product of the same manufacturer.

1.02 Acceptable Manufacturers

A. ASCO Series 300
B. Eaton.

1.03 Codes and Standards

The manual transfer switches and accessories shall conform to the requirements of:

A. UL 1008 Listed for Optional Standby Transfer Switches (Manual Transfer Switches)

B. CSA C22.2 No.178 – 1978

C. IEC 60947-6-1 Low – Voltage Switchgear and Controller

D. NFPA 70 - National Electrical Code

E. NFPA 99 – Essential Electrical Systems for Health Care Facilities

F. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

G. UL 508 Industrial Control Equipment

H. NEC Article 700.3 (F)

I. International Standards Organization ISO 90estrication 01: 2008

J. RoHs compliant (Restriction of Hazardous Substances)

K Seismic qualification – International Building Code & OSHPD to SDS level of 2.5

PART 2 PRODUCTS

2.01 Mechanically Held Transfer Switch

A. The transfer switch unit shall be manually operated and mechanically held. The switch shall be mechanically interlocked to ensure only one of three possible positions, Source 1, Source 2, or Center Off Fused disconnect type switches shall not be acceptable.

B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

C. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors.

E. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

F. Where neutral conductors must be switched, the MTS shall be provided with fully-rated neutral transfer contacts.

G. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided.

H. The MTS shall be tested in accordance with UL 1008 for transfer switches. Switch ratings of 260 amperes and less shall have endurance rating of 6000 cycles, 400 ampere shall have endurance rating of 4000 cycles, and 600 – 1200 ampere shall have endurance rating of 3000 cycles.

PART 3 OPERATION

3.01 Manual Operations Provisions

A. The transfer switch shall be arranged for manually actuated manual operation.

B. The manual transfer shall be actuated via a mechanical operating mechanism.

C. The manual operating handle shall be capable of external operation without opening the enclosure door.

D. It shall have the same contact to contact speed as automatic operation

E. There shall be three positions for manual operation:

1. Connected to Source 1 (preferred)
2. Connected to Source 2 (alternate)
3. Connected to center off (disconnected position)

F. Switch position when connected to Source 1, or Source 2 shall be pad - lockable

4.01 ENCLOSURE

A.Nema 3r. Wall Mount

B. Enclosures shall be code gauge steel as per UL 50 with ANSI #61 powder coat finish.

C. Outdoor enclosures shall be available in 316 stainless steel

5.01 ADDITIONAL FEATURES

A. Mechanical position indicators (yellow) visible to the operator shall be included for Source 1 (preferred), Source 2, (alternate), and Center Off (disconnected).

B. Optional LED indicators shall be available for Source 1 (preferred), and Source 2 (alternate).

C. Auxiliary position indicating contacts, rated 10 amps, 250 Vac shall be provided consisting of one closed when the MTS is connected to Source 1 (preferred), and one contact closed when the MTS is connected to Source 2 (alternate)

D. A form A contact shall be provided to indicate switch is in the Center Off (disconnected) position.

PART 6 ACCESSORIES

6.01 Optional Features *(The following section is optional and should be deleted if not required)*

A. Surge Suppression – A TVSS with a surge current rating of 65kA shall be provided with individually matched fused metal oxide varistors (MOVs). It shall include LED status indication of normal operation, under voltage, power loss, phase loss or component failure. Shall include form C dry contacts for external alarm or monitoring. The unit shall be enclosed in a Noryl housing rated NEMA 4, 12, and 4X. Shall comply with UL 1449 3rd edition. (This feature shall be equal to ASCO accessory 73).

PART 7 ADDITIONAL REQUIREMENTS

7.01 Withstand and Closing Ratings

A. The MTS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the MTS terminals with the type of overcurrent protection shown on the plans. WCR MTS ratings @ 480v shall be as follows when used with specific circuit breakers or current limiting fuses:

MTS Size	Withstand & Closing Rating MCCB	W/CLF
150 - 600	50,000A	200,000

800 - 1200	65,000A	200,000

7.02 Tests and Certification

A. The complete MTS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. The MTS manufacturer shall be certified to ISO 9001: 2008 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001: 2008.

7.03 Service Representation

A. The MTS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of switch shipments, by serial number, for a minimum of 20 years.

C. For ease of maintenance, the transfer switch nameplate shall include drawing numbers and serviceable part numbers.

SECTION 32 31 13 CHAIN LINK FENCES AND GATES

SCOPE Applicable provisions of the General and Supplementary Conditions and Division 1 govern work under this Section.

INDEX

PART 1 GENERAL

1.1 Description

A. Work Included: Chain link fencing gates with barb wire required for this Work is indicated on the Drawings and includes necessary accessories.

B. Related Work Specified Elsewhere
   1. Concrete Section 03 30 00

1.2 Quality Assurance

A. Qualifications for Erectors
   1. For actual installation of chain link gate, use only personnel completely trained and experienced in installation of the approved materials and thoroughly familiar with the original design and the approved Shop Drawings.
   2. Gates shall meet UL 325 Standard

1.3 Submittals: Within 35 days after award of Contract, and before any chain link fencing materials are delivered to the job site, submit to the Architect in accordance with these Specifications; the following:

A. Shop Drawings: Details of fabrication and installation.

1.4 Product Delivery, Storage and Handling

A. Protection: Use all means necessary to protect chain link fencing materials before, during and after installation and to protect the installed Work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 MATERIALS

A. Gate with 1’-0” of barb wire

1. Contractor shall furnish all of the materials and shall erect a thermal fusion bonded, galvanized coated chain link fabric fence on a steel framework to a height as noted on the Drawings.
2. Contractor shall exercise particular care in the prosecution of this work to assure that he will not come in contact with any underground electrical or telephone conduits, overhead wiring, mechanical or electrical equipment.

B. Chain Link Fence Materials
1. Basic Specifications:
   a. Height: As shown on Drawings
   b. Fabric: 2" Mesh, 9 Gauge – galvanized Coated Fabric
   c. Top Rail: 1-⅝" OD, SS40 weight – galvanized
   d. Line Posts: 2-⅜" OD, SS40 weight – galvanized
7. All posts, rails and appurtenances shall be ASTM F1043 Group IA hot-dip galvanized pipe having a zinc coating of 1.8 oz/ft² (550 g/m²) on the outside and 1.8 oz/ft² (550 g/m²) on the inside surface. Exterior of pipe to have F1043 PVC thermally fused color coating, minimum thickness 10 mils (0.254 mm). Pipe posts shall have tops which exclude moisture. End, corner, pull and gate posts shall be braced with the same material as top rail and trussed to line posts with three-eighth inch (⅜") rods and lightener's. Each post shall be set in a concrete foundation of 1-2-4 mix having a minimum diameter of nine inches (9") and at least forty-eight inches (48") deep or below frost line. Line posts shall be evenly spaced eight feet (8'-0") or less apart. Line posts may be driven 48" deep in lieu of concrete footings.
8. Standard tolerances apply. Installation shall be by experienced fence erectors, on lines and grades furnished by the Company.
9. If 95% of the materials are made in the USA Mill certifications are not required.

C. Gates – with 1'-0" of barb wire
1. Construction for rolling gate shall consist of four inch (4") O.D. gate posts and three inch (3") O.D. latch post with receiver. Gate to be constructed in a manner to insure ease of operation and maintenance.
2. Gate portion shall be fabricated with two and one-half inch (2-1/2") O.D. pipe top and bottom members and two inch (2") O.D. pipe vertical members.
3. Gate assembly shall include Pipe Frame Stiffener or equal.
4. All fencing per ASTM F1043.

PART 3 EXECUTION

3.1 Surface Conditions

A. Inspection
1. Prior to all Work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that final grading in fence location is completed without irregularities which would interfere with fence installation.
3. Verify that chain link fencing and gates may be installed in strict accordance with the original design and the approved Shop Drawings.

B. Discrepancies
1. In the event of discrepancy, immediately notify the Architect.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 Preparation

A. Measure and lay out complete fence line.

B. Measure parallel to surface of ground.

3.3 Installation

A. Install new fencing to match layout.

B. Posts
   1. Line post spacing: 8 feet on center maximum.
   2. Pull posts: Pull posts shall be installed at all points of deflection greater than 30 degrees in the line of fence and also at all points where there are abrupt changes in grade.
   3. Do not begin prior to completion of the final grading. Drill holes for posts footings in firm undisturbed or compacted soil.
   4. Minimum post hole diameter three times outside post diameter.
   5. Minimum post hole depth: 3 inches below post bottom.
   6. Place concrete in hole to depth of post bottom in a continuous pour.
   7. Set post plumb to 1/4 inch in 10 feet.
   8. Set keepers, stops, sleeves and other accessories into concrete as required.

C. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

D. Tension Wire: Install tension wires before stretching fabric and tie to each post with ties and clips.

E. Fence Fabric: The fabric shall be placed on the side of the fence as designated by the Owner or his representative.
   1. Stretch fabric tight between terminal post so that fabric remains in tension after pulling force is released.
   2. Position bottom of fabric approximately 1 inch to 2 inches above ground level at each post.
   3. Cut fabric to form one continuous piece between terminal posts.
   4. Attach fabric to terminal post using tension bars and tension band:
      a. Thread tension bars through fabric.
      b. Tension band spacing not to exceed 15 inches on center.
   5. Attach fabric to line posts using wire ties or clips, spacing not to exceed 15 inches on center.
   6. Attach top edge of fabric to top rail using wire ties or clips, spacing not to exceed 24 inches on center.
   7. Attach bottom edge of fabric to bottom tension wire using wire ties or clips, spacing not to exceed 24 inches on center.

F. Stretcher Bars: Thread through fabric and secure to posts with metal bands spaced not over 15 inches on center.

G. Gates
   1. Install gates plumb and level, 1/4 inch in 10 feet.
   2. Install ground-set items in concrete for anchorage, as recommended by fence Manufacturer.
   3. Adjust hardware to provide smooth operation.

3.4 Adjust and Clean

A. Adjust brace rails and tension rods for rigid installation.

B. Tighten hardware, fasteners and accessories.

C. Remove excess and waste materials from project site.

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