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WAYNE RESA
TRANSFORMER REPLACEMENT
WAYNE, MICHIGAN

Project Manual

IDS Project No. 20203-1000

October 16, 2020
Bids

Project Manual

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SECTION 26 0500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this Section.
- B. This Section shall apply to all Division 26 Sections.

1.2 SUMMARY

- A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01 Sections.
 - 1. Codes and standards
 - 2. Quality assurance
 - 3. Examination of drawings and premises
 - 4. Substitutions
 - 5. Alternates that apply to the electrical work
 - 6. Permits, fees and inspections
 - 7. Changes involving Electrical Work
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 - 10. Operation and maintenance manuals and equipment
 - 11. Delivery, storage and handling
 - 12. Warranty
 - 13. Description of electrical systems
 - 14. Scope of work specified in Division 26
 - 15. Related work specified in other Divisions
 - 16. Systems provided by the Owner
- B. Part III – Execution:
 - 1. This section includes basic requirements for installations for electrical work.
 - a. Electrical demolition work

1.3 CODES AND STANDARDS

- A. The electrical characteristics, physical properties, design, performance characteristics, methods of construction, all material and the installation techniques, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:
 - 1. ADA – Americans with Disabilities Act
 - 2. AEIC – Association of Edison Illuminating Companies
 - 3. ANSI - American National Standards Institute
 - 4. ASTM - American Society for Testing Materials
 - 5. BICSI - Building Industry Consulting Service International
 - 6. FCC - Federal Communication Commission
 - 7. ICEA - Insulated Cable Engineers Association
 - 8. IEC – International Electrotechnical Commission
 - 9. IEEE - Institute of Electrical and Electronics Engineers
 - 10. MBC – Michigan Building Code
 - 11. MIOSHA – Michigan Occupational Safety Hazard Association
 - 12. NEC - National Electrical Code

13. NETA – International Electrical Testing Association
14. NEMA - National Electrical Manufacturer's Association
15. NFPA - National Fire Protection Association
16. OSHA – Occupational Safety and Health Act
17. UL - Underwriters Laboratories, Inc.

1.4 QUALITY ASSURANCE

- A. Furnish all labor, materials, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the electrical systems as specified in the Division 26 Sections and as indicated on Drawings.
 1. The Electrical Drawings indicate the general design and extent of the electrical system. Comply with the Drawings as closely as actual construction of the building and the work of other Trades permit.
- B. Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.
 1. All equipment of the same or similar systems shall be by the same manufacturer.
- C. Regulatory Requirements:
 1. Ordinances, Codes and Standards: Perform all work in accordance with applicable Federal, State and local ordinances and regulations. Perform all work to comply with Codes and Standards identified in these specifications.
 - a. Notify the Architect/Engineer before submitting his proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations. After entering into Contract, make all changes required to conform to above ordinances, rules and regulations without additional expense to the Owner.
 - b. Barrier-Free Regulations: All materials and installations shall comply with the requirements of the State of Michigan Handicapped Barrier-Free Regulations and with the Americans with Disabilities Act (ADA).
- D. Rules of Local Utility Companies:
 1. Perform work in accordance with the rules of local utility companies. Before submitting the bid check with each utility supplying service to this Project. Determine from them all equipment and charges which they will require and include the cost in the bid.
- E. Field Measurements:
 1. Drawings are not intended to be scaled for roughing-in or to serve as shop drawings. Take all field measurements required for fitting the installation to the building.
- F. Sequencing and Scheduling: Sequence and schedule work so as to avoid interference with the work of other Trades. Be responsible for removing and relocating any work which in the opinion of the Owner's Representatives causes interference.

1.5 EXAMINATION OF DRAWINGS AND PREMISES

- A. Before submitting Bids, examine the site, architectural, mechanical and other trades' drawings and specifications.
 1. Notify Architect/Engineer should any discrepancies occur between them and the electrical work.

2. No additional charges will be allowed because of failure to make this examination, or to include all materials and labor required for the Electrical Work specified in other trade's documents or required due to existing conditions.
3. Before submitting Bids, examine the premises to determine existing conditions for performing the Work. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.
4. The Architectural Drawings take precedence in all matters pertaining to the building structure, Mechanical drawings in all matters pertaining to Mechanical trades and Electrical drawings in all matters pertaining to Electrical trades installation. However, where there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect/Engineer who shall determine the course of action to be taken.

1.6 SUBSTITUTIONS

- A. Base Bid shall be in accordance with materials or products specified. Any exceptions to this shall be approved in writing by the Architect/Engineer ten (10) days or more prior to bidding.

1.7 ALTERNATES

- A. Mandatory Alternates:
 1. The Contractor shall refer to Alternates listed in Division 01 and Proposals and shall submit price quotations for the alternates that apply to the electrical work.
- B. Voluntary Alternates:
 1. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the Bid, but will not affect the awarding of the Contract.

1.8 PERMITS, FEES AND INSPECTIONS

- A. Obtain all permits, licenses, inspections and test required. Upon completion of the Work, obtain and send certificates of inspections and approvals to the Architect/Engineer.
 1. Pay all fees and expenses for permits, licenses, tests and inspections.
 2. A copy of the final approved Certificate of Electrical Inspection shall be provided as a requirement prior to final payment.

1.9 CHANGES INVOLVING ELECTRICAL WORK

- A. The design of the electrical systems is based on the mechanical and building equipment specified and scheduled on the Drawings.
 1. Where equipment changes are made that involve additional electrical work (increased motor horsepower or increased unit full load amperes, requirements for a disconnect switch scheduled to be part of the equipment, requirements for a starter scheduled to be part of the equipment, additional wiring of equipment, etc.) the Mechanical or respective trades involved shall compensate the electrical trades for the cost of the additional work required.

1.10 SUBMITTALS

- A. The following is in addition to the requirements for submittals in Division 01.
- B. Material List: Submit a complete list of all materials, equipment, and their manufacturers, for approval by the Architect/Engineer within 15 days after award of contract and prior to submittal of shop drawings.

- C. Provide equipment submittals in the form of letters of intent, product data catalog sheets or shop drawings as hereinafter specified for all materials provided on the project.
- D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
 - 1. Provide a space approximately 4" x 5" on the label or beside the title block on shop drawings to record the Contractor's review and approval markings and the action taken.
 - 2. Include the following information on the label for processing and recording action taken.
 - a. Project Name
 - b. Date
 - c. Name and address of Architect/Engineer
 - d. Name and address of Contractor
 - e. Name and address of Subcontractor
 - f. Name and address of Supplier
 - g. Name of Manufacturer
 - h. Number and title of appropriate Specification Section
 - i. Drawing number, identification mark, fixture type, panelboard number, specification section number, and detail references, or as noted on the electrical drawings.
- E. Equipment submittals shall be reviewed by the Electrical Contractor for completeness and accuracy and prior to submitting to the Architect/Engineer for review. Submittals shall be dated and signed by the Electrical Contractor. Note on the submittal any and all exceptions or changes to the drawings and specifications required by the submittal to meet the specified products.
- F. Partial submittals for equipment shall not be permitted. Where partial submittals are transmitted to the Architect/Engineer, they will be returned "Rejected".
- G. Where the equipment submittals consist of manufacturer's standard detail drawing or schedules and contain data for a variety of similar equipment, indicate the data pertinent to the equipment furnished for this project only. Standard detail drawings and schedules not clearly indicating which data is associated with this Project shall be returned "Rejected".
- H. Where accessories and/or options are specified and do not appear as part of manufacturer's standard detail drawings, state each accessory that is to be provided with the equipment on the standard detail drawings.
- I. Letter of Intent shall state that the product is exactly as specified with no exceptions, and that the product is being manufactured by one of the specified manufacturers. The Letter of Intent shall include the specification section number, the product description, the name of the selected manufacturer and the catalog number of the product. The aforementioned information shall be typed on the Electrical Contractor's letterhead and submitted with one (1) product data sheet for each product itemized in the Letter of Intent for record.
- J. No apparatus or equipment shall be shipped from stock or fabricated until equipment submittals for them have been reviewed and approved by the Architect/Engineer. By the review of shop drawings, the Architect/Engineer does not assume responsibility for actual dimensions or for the fit of completed work in position, nor does such review relieve Electrical Trades of full responsibility for the proper and correct execution of the work required.

- K. Submittals shall be provided on all major electrical systems and/or equipment, including the following:

REMARKS LEGEND

Provide the following as indicated:

- | | |
|---------------------------------------|--|
| 1. Factory Test Report | 8. Points List |
| 2. Field Testing Report | 9. Sequence of Operation |
| 3. Record Drawings | 10. Certificate of Inspection |
| 4. Mock-Up | 11. Installer Certificate & Master Label |
| 5. Material & Equip. List/Certificate | 12. Fire Marshal Approval |
| 6. Operation & Maintenance Manuals | 13. Tools/Spare Parts |
| 7. Construction Schedule | 14. _____ |

Section Number	Section Title	Shop Dwgs.	Product Data	Letter of Intent	Samples	Warranty	Remarks
26 0500	Common Work Results for Electrical					X	6, 7, 10
	Materials List			X			5
	Electrical Systems Description						
26 0553	Identification for Electrical Systems						
	Electrical Identification Product		X		X		
	Schedule of Nomenclature			X			
26 0570	Electrical Testing and Power System Studies						
	Tests on Distribution Transformers						2
26 2213	Low Voltage Distribution Transformers (1000V and Less)						
	Distribution Transformers		X				

1.11 PROJECT RECORD DOCUMENTS

- A. Project Record Documents: Revise layout shop drawings as required during construction to indicate the as-built condition.

- At the completion of the Project, resubmit to the Owner's Representative the revised set of "redlined" blueines, (or electronic files with all changes from the bid documents bubbled) and one set of prints indicating "as-built" conditions for Owner's record. The Drawings shall contain all title block information as originally issued by the Architect/Engineer with the addition of the electrical contractor's company name, address, telephone number, company's project number, date of issuance by the electrical contractor, and issued for "Final Issue" conditions in title.
- Furnish and deliver to the Owner's Representative a manual of all shop drawings and product data upon substantial completion. The manual shall consist of a standard hard cardboard, vinyl covered, 3-ring binder, letterhead size, 8-1/2" x 11". Shop drawings shall be folded and punched. All items and pages shall be numbered with typewritten index inserted at front of manual.
- Submit final project record documents as described in Division 1.

1.12 OPERATION AND MAINTENANCE MANUALS AND EQUIPMENT

- A. Operation and Maintenance Manuals: The manuals shall contain operating instructions, service instructions, parts lists, etc., which are shipped with electrical equipment. On completion of the work, transmit these items to the Architect/Engineer, for the Owner's use. If this information is not shipped with the equipment, obtain from the manufacturer.

- B. Maintenance Materials: Retain all portable and detachable portions of the installation such as keys, tools, manuals, etc., until the completion of the work and then transmit them to the Owner and obtain itemized receipt. This receipt shall be attached to the "Final Application" for payment.
- C. Furnish three (3) sets of bound operation and maintenance manuals to the Architect/Engineer. Each set shall include:
 - 1. One (1) copy of all shop drawings and product data
 - 2. One (1) copy of operation and maintenance instructions and manuals
 - 3. One (1) copy of all electrical testing results
 - 4. One (1) copy of as-built drawings

1.13 DELIVERY, STORAGE AND HANDLING

- A. Storage and Protection: Provide adequate storage space for all electrical equipment, conduit and materials delivered to the job site under a weather protected enclosure. Location of the space will be designated by the Owner's Field Representative. Equipment set in place in unprotected areas must be provided with temporary protection.
 - 1. Be responsible for the care and protection of electrical equipment until it has been fully tested and accepted.
 - 2. Protect materials with permanent factory finish from damage by covering.
 - 3. Protect conduit openings with temporary plugs or caps.

1.14 WARRANTY

- A. Warranty: Provide a one year parts and labor warranty for all equipment and installation. Comply with requirements of the General Conditions.

1.15 SCOPE OF WORK SPECIFIED IN DIVISION 26 SECTIONS

- A. Furnish all labor, materials, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the electrical systems as specified in the Division 26 Sections.
- B. Provide control wiring greater than 100 volts for temperature, pressure, level and control devices, solenoid valves, control relays, and MCC control wiring, and all power wiring, required for equipment specified hereinafter.
- C. The principal items of electrical work to be furnished and installed shall include but not necessarily be limited to the following items:
 - 1. Demolition work as indicated on the drawings and as required to accommodate the network.
 - 2. Indoor transformer.
 - 3. Testing of transformers.
 - 4. All items incidental to and/or required to complete the installation.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 EQUIPMENT FOUNDATIONS AND SUPPORTS

- A. Provide leveling channels for floor-mounted equipment such as transformers.

3.2 ASSEMBLY AND CONNECTION OF EQUIPMENT

A. Assembly of Equipment:

1. The Contract Drawings and Specifications indicate items to be purchased and installed which are noted by a manufacturer's name, catalog number and/or brief description.
2. The catalog number may not designate all the accessory parts and appurtenances required for the particular use or function.
3. Arrange with the manufacturer for the purchase of all items required for the complete installation and efficient operation.

B. Equipment Connections:

1. Connections to equipment shall be made in accordance with the shop drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished.
2. Any and all additional connections not shown on the Drawings but called for by the equipment manufacturer's shop drawings or required for the successful operation of the particular equipment furnished shall be installed as part of this Contract at no additional charge to the Owner.

3.3 FIELD QUALITY CONTROL

A. Testing Ducts and Conduits: Ducts and conduits which are installed underground or concealed in concrete floor slab, foundations, etc., shall be cleared of foreign material and obstructions after installation and before conductor or pullwires are draw-in, by wire brushing, swabbing and employing an iron or hardwood mandrel which is 1/4" smaller in diameter than the internal diameter of the duct or conduit. Pulling wires shall be left in empty conduits.

B. Tests and Inspection:

1. When the systems are completed, operate equipment as directed by Architect/Engineer. Replace all faulty equipment. Make necessary adjustments before final acceptance.
2. Tests shall include but not be limited to panels, lighting fixtures, receptacles, fire alarm system, generator, transfer switch, sound systems, emergency lighting, branch circuits, etc.
3. Perform all tests required by State, City, County and/or other agencies having jurisdiction.
4. Provide all materials, equipment, etc., and labor required for tests.

C. Cleaning:

1. Keep premises free from accumulation of waste materials and rubbish. At completion of work remove all rubbish from and about the building and leave the electrical systems clean and ready for use.
2. Final clean-up shall include washing of fixture lenses, switchboards, substations, transformers, motor control centers, distribution panels, lighting panels, etc., to remove shipping and/or construction dust and debris. Fixture reflectors and/or lenses with water marks or cleaning streaks will not be accepted.

D. Painting:

1. In general, no painting is required by Electrical Trades other than touch-up of factory-finished electrical equipment.
2. All factory finished electrical equipment shall be cleaned at completion of the job. Equipment showing rust or mars shall be thoroughly cleaned and sanded, prime coated and touched up with enamel of color to match original finish.

E. Laying Out Exterior Work:

1. All exterior manholes, handholes, utility poles, lighting poles, bollards and similar equipment shall be staked by this contractor and approved by the engineer prior to installation.

END OF SECTION 26 0500

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment identification nameplates

1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 [and IEEE C2].
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION NAMEPLATES

- A. Engraved, Plastic Laminate or Laminated Acrylic: Punched or drilled for screw mounting. Black engraved letters on a white face. Minimum letter height shall be **1/4 inch**.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

3.2 EQUIPMENT IDENTIFICATION NAMEPLATES

- A. Equipment Identification Nameplates: On each unit of equipment, install unique designation label that is consistent with one line diagram tag nameplates, wiring diagrams, schedules, and the Operation and Maintenance Manual
 - 1. Labeling Instructions:
 - a. Indoor and Outdoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with **1/4 inch** high letters on **1-1/2 inch** high label.
 - b. Fasten nameplates with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 - 2. Equipment to Be Labeled:
 - a. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.

END OF SECTION 26 0553

SECTION 26 0570 – ELECTRICAL TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

1.2 SUMMARY

- A. General Scope:
1. The Electrical Contractor shall perform inspections and tests as herein specified.
 2. The Electrical Contractor shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.
 3. It is the intent of these tests to assure that all electrical equipment, both contractor and owner supplied, is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.
 4. The tests and inspections shall determine suitability for energization.
- B. Applicable Codes, Standards and References:
1. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.
 - a. American National Standards Institute - ANSI
 - 1) ANSI C2: National Electrical Safety Code
 - 2) ANSI Z244-1: American National Standard for Personnel Protection
 - b. American Society for Testing and Materials - ASTM
 - c. Association of Edison Illuminating Companies - AEIC
 - d. Electrical Apparatus Service Association - EASA
 - e. Institute of Electrical and Electronic Engineers - IEEE
 - f. Insulated Cable Engineers Association - ICEA
 - g. International Electrical Testing Association - NETA
 - h. National Electrical Manufacturer's Association - NEMA
 - i. National Electrical Code - NEC
 - j. National Fire Protection Association - NFPA
 - 1) ANSI/NFPA 70B: Electrical Equipment Maintenance
 - 2) NFPA 70E: Electrical Safety Requirements for Employee Workplaces
 - 3) ANSI/NFPA 70: National Electrical Code
 - 4) ANSI/NFPA 78: Lightning Protection Code
 - 5) ANSI/NFPA 101: Life Safety Code
 - k. Occupational Safety and Health Administration - OSHA
 - 1) OSHA Part 1910; Subpart S, 1910.308
 - 2) OSHA Part 1926; Subpart V, 1926.950 through 1926.960
 - l. Underwriters Laboratories, Inc. - UL
 - m. State and Local Codes and Ordinances

2. All inspections and tests shall utilize the following references:
 - a. Project Design Specifications.
 - b. Project Design Drawings.
 - c. Project Short Circuit, Arc Flash Hazard and Coordination Study.
 - d. Manufacturer's instruction manuals applicable to each particular apparatus.

C. Division of Responsibility:

1. The Electrical Contractor shall perform routine insulation resistance, continuity and rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.
2. The Electrical Contractor shall supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the specific power requirements.
3. Any system, material or workmanship which is found defective on the basis of acceptance tests shall be reported.

D. Electrical Tests: Furnish all labor, materials, test equipment, and technical supervision to perform and record the electrical tests as specified, and perform and record all electrical tests as required, including tests on:

1. Transformers, Dry-Type, Air-Cooled, Low Voltage, Small (0-500 KVA)

E. Preliminary Inspections and Tests:

1. Visual inspections of electrical equipment, wire checks of factory wiring and any other preliminary work required to prevent delays during performance of electrical acceptance tests.

F. Electrical Acceptance Tests:

1. Those inspections and tests required to show that the workmanship, methods, inspections, and materials used in erection and installation of the electrical equipment conforms to accepted engineering practices, IEEE Standards, IPCEA-NEMA Standards, the National Electrical Code, manufacturer's instructions, and Division 26 Sections, and to determine that the equipment involved may be energized for operational tests.

G. Operating Tests:

1. Those tests performed on all electrical equipment installed under Division 26 Sections, and under other Sections, to show that the electrical equipment will perform the functions for which it was designed.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Refer to Section 260500, "Common Work Results for Electrical".
- B. Operating tests on mechanical and electrical equipment installed under other Sections to prove capability of such equipment to perform as specified in the Section covering specific equipment.
- C. Repair or replacement of equipment installed under other Sections and not meeting acceptance tests specified in this Section and therefore not acceptable.
- D. Uncoupling of motors installed under other Sections where reverse rotation could damage equipment during acceptance tests for proper rotation.

1.4 PERFORMANCE REQUIREMENTS

- A. Final acceptance of electrical equipment will not only depend on equipment integrity as determined by the electrical acceptance test, but will also depend on complete operational tests, whether performed under this or other Sections.

1.5 SUBMITTALS

- A. Test Reports:
1. The test report shall include the following:
 - a. Project Name: Obtain from project manual.
 - b. A/E Firm: Integrated Design Solutions, LLC
 - c. A/E Address: 1441 W. Long Lake Road, Suite 200, Troy, MI 48098
 - d. A/E Project Number: Obtain from project manual.
 - e. Name of testing organization.
 - f. Address of testing organization.
 - g. Name of individual performing tests.
 - h. Description of tests.
 - i. Test data.
 - j. Analysis and recommendations.
 - k. Description of equipment tested and its number/name.
 - l. Humidity, temperature, and other conditions that may affect the results of the tests and/or calibrations.
 - m. Date of inspections, tests, maintenance, and/or calibrations.
 - n. Identification of the testing technician.
 - o. Indication of inspections, tests, maintenance, and/or calibrations to be performed and recorded.
 - p. Indication of expected results when calibrations are to be performed.
 - q. Indication of "as-found" and "as-left" results, as applicable.
 - r. Sufficient spaces to allow all results and comments to be indicated.
 2. Submit test reports, including complete data on actual readings taken and corrected values, to the Architect/Engineer for approval after each test period. Have all test reports signed by the authorized witnesses present at tests prior to submission. Do not energize any equipment or material for operating tests until test data has been approved.
- B. Submit five (5) copies of final approved test reports to the Owner at the completion of the work under this Section.

1.6 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:
1. Do not perform megger or high potential tests during times of high relative humidity.
 2. Do not perform tests on outdoor equipment during inclement weather. Do not perform tests on direct burial bare ground conductors or on ground rods within a 48 hour period following rainfall.

B. Safety Precautions:

1. All parties involved shall be cognizant of applicable safety procedures. This document does not include any procedures, including specific safety procedures. It shall be understood and clear that an overwhelming majority of the tests and inspections recommended in these specifications are potentially hazardous. Individuals performing these tests shall be trained and capable of conducting these tests in a safe manner and with complete knowledge of the hazards involved. Safety practices shall include, but are not limited to, the following requirements:
 - a. All applicable provisions of the Occupational Safety and health Act, particularly OSHA 29CFR 1910.
 - b. Accident Prevention Manual for Industrial Operations, National Safety Council.
 - c. Applicable state and local safety operating procedures.
 - d. Owner's safety practices.
 - e. ANSI/NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.
2. A safety lead person shall be identified prior to commencement of work.
3. A safety briefing shall be conducted prior to the commencement of work.
4. All tests shall be performed with the apparatus de-energized and grounded except where otherwise specifically required to be ungrounded or energized for certain tests.
5. The testing organization shall have a designated safety representative on the project to supervise operations with respect to safety.
6. During cable tests, station a person at each point where cable has exposed connections. Supply each person with a two-way communication device.

C. Suitability of Test Equipment:

1. All test equipment shall meet the calibration requirements found in these specifications and shall be in good mechanical and electrical condition.
2. Field test metering used to check power system meter calibration shall be more accurate than the instrument being tested.
3. Accuracy of metering in test equipment shall be appropriate for the test being performed.
4. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and the tested equipment.

D. Test Instrument Calibration:

1. The testing organization shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy for each test instrument calibrated.
2. The firm providing calibration service shall maintain up-to-date instrument calibration instructions and procedures for each test instrument calibrated.
3. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).
4. Instruments shall be calibrated in accordance with the following frequency schedule:
 - a. Field instruments: Analog, 6 months maximum. Digital, 12 months maximum.
 - b. Laboratory instruments: 12 months maximum.
 - c. Leased specialty equipment: 12 months maximum.
5. Dated calibration labels shall be visible on all test equipment.
6. Records, which show date and results of instruments calibrated or tested, must be kept up to date.
7. Calibrating standard shall be of better accuracy than that of the instrument tested.

1.7 SEQUENCE AND SCHEDULING

- A. Perform all acceptance and operating tests in the presence of the Architect/Engineer.

- B. Schedule sequence of tests so that equipment can be energized immediately after completion of the applicable tests and approval of test reports. Notify the Architect/Engineer of time of test at least 48 hours prior to testing.
- C. Notify vendors and manufacturers of electrical equipment of the time of tests and extend reasonable cooperation to them or their representatives to permit them to witness tests should they so request. Obtain list of manufacturers of Owner furnished equipment from the Architect/Engineer.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 MEGGER TESTS

- A. Megger tests shall be provided for the following equipment:
 - 1. Dry type transformers
- B. Megger readings specified are the minimum readings desired at an ambient temperature of 60 degF (15.56 degC) and at a low relative humidity. When megger readings are taken at other than 60 degF, convert readings to equivalent values at 60 degF.
- C. When megger readings fall below the specified minimum values at 60 degF, devise some means of applying heat for the purpose of drying out the equipment subject to the approval of the Architect/Engineer. If drying is to be done by applying an electric potential to a piece of equipment, do not exceed the continuous voltage or current ratings of the equipment being dried, either directly or by induction.

3.2 CONTINUITY TESTS

- A. Perform continuity tests with a DC type device using a bell or buzzer. Do not use phones for continuity test; use phones only for communication.

3.3 TESTS ON DRY-TYPE TRANSFORMERS (500 KVA AND LESS)

- A. Visual and Mechanical Inspection:
 - 1. Compare equipment nameplate data with drawings and specifications. Report differences in test report and include on contractor's "as-built" drawings.
 - 2. Inspect physical and mechanical condition.
 - 3. Inspect anchorage, alignment, grounding, and required area clearances.
 - 4. Verify that resilient mounts are free and that any shipping brackets have been removed.
 - 5. Verify the unit is clean.
 - 6. Verify that fuse and/or circuit breaker sizes and types correspond to drawings and coordination study as well as to the circuit breaker's address for microprocessor-communication packages.
 - 7. Verify that current and voltage transformer ratios correspond to drawings.
 - 8. Inspect bolted electrical connections for high resistance using one of the following methods:
 - a. Use of low-resistance ohmmeter.
 - b. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
 - c. Perform thermographic survey.
 - 9. Verify that as-left tap connections are as specified.
 - 10. Check continuity and correctness of connections of windings.
- B. Connections: Isolate transformer by opening the line side switch or circuit breaker and disconnect secondary conductors at panels. Tie conductors together on each winding.

C. Electrical Tests:

1. Megger Test: Perform insulation-resistance tests for each winding-to-winding and each winding-to-ground. Ground all windings not in the test to the same ground. The tests and results shall be as follows:

<u>Equipment to be Tested</u>	<u>Apply These Tests</u>	<u>Acceptable Test Results</u>	
Transformer Coil Rating In Volts	Megger DC Test Voltage	Minimum acceptable insulation resistance in megohms	Maximum acceptable insulation leakage current in microamperes
0-300	500	100	5
301-600	1000	500	2
601-5000	2500	5000	.5
5001 - greater	5000	25,000	.2

2. Turns Ratio Test: Perform a turns ratio test for all transformers 75 KVA and larger. Acceptable test results - maximum 1/2 percent deviation from calibrated tap valve or 1/2 percent deviation from either adjacent coil.
3. Verify correct secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

D. Acceptance: Transformers must pass all inspections and tests.

E. Records:

1. Make complete and accurate records of each test. Include the following in each test report:
 - a. Complete identification of transformer.
 - b. Megger readings, including converted values and ambient temperature at time of test.
 - c. Turns ratio: Test including test results and calculated deviation from specified top value.

END OF SECTION 26 0570

SECTION 26 2213 – LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. Low voltage dry-type distribution transformers as indicated or specified. Provide equipment supports and identification as specified.
- B. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the Drawings, and as specified herein for a complete operating system.
- C. Related Sections:
 - 1. Application Sections of Division 26 - Electrical.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 01 Specification Sections.
- B. Submit shop drawings and complete product data on each item of the following:
 - 1. Dry-type transformers.

1.4 QUALITY ASSURANCE

- A. Comply with NEC as applicable to the installation and construction of electrical power/distribution transformers.
- B. Comply with applicable portions of NEMA Std. Pub/Nos. ST-20 and ANSI C57.12.50 pertaining to power/distribution transformers.
- C. Comply with applicable requirements of ANSI/UL 506 "Safety Standard for Specialty Transformers". Provide power/distribution transformers and components that are UL listed and labeled.

PART 2 - PRODUCTS

2.1 DISTRIBUTION TRANSFORMERS

- A. For Indoor Dry Locations in General: Metal-enclosed, ventilated indoor dry, two-winding quiet type, per NEMA Standards, having 115 degC rise; insulation, copper windings, a minimum of two 2-1/2% full capacity above and four 2-1/2% full capacity below normal voltage taps in the primary windings, and provisions for conduit connections. Furnish transformers having voltage and KVA ratings and connections as indicated.
 - 1. Manufacturer: Provide products of one of the following:
 - a. Eaton Cutler-Hammer "DS-3" and "DT-3"
 - b. General Electric "QL"
 - c. Siemens
 - d. Square D "EE"

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractors shall install all equipment per the manufacturer's instructions, contract drawings and National Electrical Code.
- B. Transformers shall have a minimum of 6" clearance from any obstructions for air circulation on all four (4) sides.
- C. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and secured to the floor. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

3.2 FIELD ADJUSTMENTS

- A. The Contractor shall perform field adjustments of the transformer taps as required to place the equipment in final operating condition.

3.3 EQUIPMENT SUPPORTS

- A. Anchor all self-supporting equipment securely to floors and to supporting steel where such supports are indicated or required.
- B. Provide supports for transformers supported from structural steel, or wall bracketed with structural pieces, inserts, anchors and bolts for this purpose.

3.4 EQUIPMENT IDENTIFICATION

- A. Provide identification on all electrical equipment installed. Refer to Section 260553.

3.5 TOUCH-UP PAINTING

- A. On all equipment installed, touch-up paint all manufacturer's standard finished equipment surfaces damaged during construction to "as new" condition with original manufacturer's finish paint.

END OF SECTION 26 2213